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Page
Factors Affecting Farm Income, Farm Prices, and Food Consumption — *Karl A. Fox* 65
Economic Research in Farm Electrification — *Joe F. Davis* 82
Recent Relationships between Income and Food Expenditures — *Marguerite C. Burk* 87
Changes in Production during World War II — *Jackson V. McElveen* 98
Book Reviews — *Sherman E. Johnson, James P. Cavin, O. V. Wells, Caroline Sherman, Hugh H. Wooten,* and *Arthur F. Raper* 103

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AGRICULTURAL ECONOMICS RESEARCH

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Volume III JULY 1951 Number 3

Factors Affecting Farm Income, Farm Prices, and Food Consumption

By Karl A. Fox

Agricultural price analysis was one of the hard cores around which the agricultural economics of the 1920's and early 1930's were built. Since then, in all too many cases the working economists have been too busily engaged in current operations to set down their appraisals of price-making forces in any formal way. Many have drifted from recognized statistical methods to a shorter-run, almost wholly intuitive, "market feel" approach. Some of the theoretical or teaching economists, especially the mathematically trained group, have gone in the opposite direction, stressing models, structural equations, and the substitution of symbols for statistics. In one sense this article returns to an earlier tradition, once again substituting statistical values for symbols, and at the same time formally setting down both the methods and the results in such a way that they can be checked, in terms of both theory and experience.

But Fox has gone beyond the earlier tradition in a number of respects. Commodities accounting for a large proportion of farm income are treated in a consistent manner. The marketing system is recognized as a separate entity standing between consumer demand at retail prices and that of processors and dealers at the farm or local level. The statistical methods used are relatively simple, but they have been chosen after careful consideration of the theories and more complex equation forms advanced by the mathematical economists and econometricians. Suggestions are offered as to means of reconciling both family-budget and time-series information relating to the demand for food.

The more technical part of the article is preceded by a discussion of factors affecting the general level of farm income and the demand for farm products as a group.—O. V. Wells

Sources of Cash Farm Income

ONE APPROACH to the subject of demand for farm products is to consider the stream of goods marketed from farms and the ultimate destinations of the components of that stream. A stream of cash receipts flows back to farmers from each of the component flows of goods.

The volume of cash received from a particular source is only an approximate measure of its importance in the determination of farm income. The net effect of each flow of goods depends upon the elasticity of demand for farm products in other uses as well. For example, if there had been no price-support program on corn and cotton in 1948, cash income from commercial sales might have been considerably lower.

In table 1, cash receipts are separated into five components: (1) sales to other farmers, (2) sales to domestic consumers, (3) sales to the U. S. armed forces, (4) sales for export, and (5) net proceeds from price-support loans.

The first of these components, sales to other farmers, is frequently overlooked. In 1949, some

TABLE 1.—*Sources of cash farm income, United States, 1940, 1944, and 1949*

Source	Cash farm income[1]		
	1940	1944	1949
	Bil. dol.	*Bil. dol.*	*Bil. dol.*
1. Sales to other farmers[2]	*0.9*	*2.0*	*3.1*
a. Livestock	0.5*	0.7*	1.4*
b. Feed[3]	0.4	1.3	1.7
2. Sales to domestic consumers	*6.8*	*14.5*	*20.3*
a. Food	6.0*	11.7*	18.0*
b. Fibers[4]	0.5	1.1	1.3
c. Tobacco	0.2	0.6	0.7
d. Other[5]	(0.1)	(1.1)	(0.3)
3. Sales for the U. S. armed forces (food only)[6]	-----	*1.9*	*0.3*
4. Sales for export[7]	*0.4*	*1.8*	*2.8*
5. Net proceeds from price support loans[8]	*0.3*	*0.2*	*1.6*
Total, all sources	8.4*	20.4*	28.1*

[1] Each stream of goods valued at farm prices. Most of these figures are unofficial estimates. Asterisks denote official estimates (rounded).

[2] Used for further agricultural production.

[3] Fifty-five percent of total farm expenditures for purchased feed in 1944 and 1949; 45 percent in 1940.

[4] Cotton, wool, and mohair.

[5] Net result of (a) sales of miscellaneous nonfood crops, (b) equivalent farm value of hides and other nonfood livestock byproducts, (c) changes in commercial nonfarm stocks, (d) farm income from CCC price-support purchases minus CCC sales which appear in domestic consumption, purchased feed, and exports, and (e) errors of estimation and rounding.

[6] Excluding purchases for civilian feeding in occupied territories.

[7] Including military shipments for civilians in occupied territories.

[8] Net proceeds to farmers from CCC loans. Does not include returns from CCC purchase and disposal operations, as on potatoes.

1,363 million dollars' worth of livestock (mainly feeder and stocker cattle) were sold by one group of farmers, were shipped across State lines, and were bought by other farmers. This represents an internal flow of commodities and money within agriculture, and is not a net contribution from agriculture to other sectors of the economy. Farmers in 1949 also spent 3,080 million dollars for purchased feed. According to rough calculations, approximately 55 percent of this amount, or 1,700 million dollars, was reflected back into cash receipts for other farmers.

The movement of livestock and feed between farmers in 1949 accounted for 3.1 billion dollars, or about 11 percent of total cash receipts from farm marketings. The value of this internal flow is affected by changes in prices of livestock and feeds and by changes in the volume of movement between farms.

The second and by far the largest component of cash receipts is derived from sales to domestic civilian consumers. The total amount of this flow in 1949 was about 20.3 billion dollars. Between 85 and 90 percent of the total (18.0 billion dollars) was from sales of food. Sales of cotton, wool, and mohair, returned 1.3 billion dollars, and sales of tobacco for domestic use 0.7 billion dollars. The other item shown in table 1 under sales to domestic consumers is really a residual from the remaining calculations in the table, and is explained in its footnote 5.

The third component of cash farm income is from sales to the armed forces for the use of our own military personnel. During most of the postwar period, the military has also bought food for relief feeding in occupied territories. As these shipments are included in the value of exports (item 4 of table 1) and as their volume is not directly dependent on the size of the armed forces, they are not included here. Food used by the armed forces represented only about 1½ percent of our total food supplies in 1949. At the height of our war effort in 1944, however, the armed forces required nearly 15 percent of our food supply.

The fourth major component of farm income is from sales to foreign countries, and military shipments for civilian feeding in occupied areas. For several years the volume of exports has been unusually dependent upon programs of the U. S. Government. During 1949, more than 60 percent of the total value of agricultural exports was financed by ECA and military relief feeding programs.

The fifth component is net proceeds to farmers from CCC commodity loans. Under the terms of price-support legislation this is a residual source of income after all commercial demands at the prescribed price-support levels have been satisfied. During 1949, loans taken out by farmers on commodities exceeded farmers' redemptions of such loans by some 1.6 billion dollars. Although this item represented a substantial contribution to cash farm income in 1949, it could well be a negative item in other years. The rapid redemption of cotton of the 1949 crop during the summer of 1950 is an excellent illustration of this.

Table 1 shows that the great bulk of cash farm income is determined by domestic factors. More than 70 percent of total cash receipts come from sales to domestic consumers. The 10 or 11 percent of cash receipts representing sales to other farmers moves with the domestic demand for livestock products. The volume of food required for our armed forces depends upon governmental decisions. Even sales for export are considerably influenced by domestic factors. This point is developed further in the following section.

Factors Affecting General Level of Farm Income

A number of basic factors must be considered in appraising the outlook for farm income at any given time.

Disposable Income of Consumers. — The disposable income of domestic consumers has proved to be the best over-all indicator of the demand for agricultural products consumed by them. Our livestock products, fresh fruits, and vegetables are consumed almost wholly in this country. Cash receipts from these products are closely associated with year-to-year changes in disposable income. Disposable income affects receipts from such export crops as wheat, cotton, and tobacco, but foreign demand conditions are also highly influential.

Obviously, a key problem in forecasting demand for farm products is to anticipate changes in disposable income. To see the factors that influence this variable, we must place it in a still broader context—that is, the total volume of economic activity of individuals, corporations and Government. Table 2 shows the major components of this total as estimated by the Department of Commerce.

In most years the strategic factors causing changes in disposable income are (1) gross private domestic investment and (2) expenditures of Federal, State, and local Governments. Government expenditures are a substantial factor in the peacetime economy, and the dominant element in time of mobilization or war. Gross private domestic investment includes new construction — residential, commercial, and industrial—expenditures for producers' durable equipment, and changes in business inventories.

The Securities and Exchange Commission has had considerable success in estimating changes in business expenditures for new plant and equipment on the basis of information submitted by businessmen. Actual construction of buildings or delivery of heavy equipment lags several months to a year behind the issuance of contracts or orders. Hence, knowledge of new contracts and orders gives us valuable insights into the level of employment and industrial activity to be expected several months ahead.

Table 2.—*Gross national product, disposable income, and consumer expenditures, United States, 1950*

Item	Amount
	Billions of dollars
A. Expenditure Account	
Gross national product	*279.8*
Government purchases of goods and services	*42.1*
Federal	22.7
State and local	19.4
Gross private domestic investment	*49.4*
Nonfarm residential construction	12.5
Other construction	9.3
Producers' durable equipment	23.4
Change in business inventories	4.1
Net foreign investment	*—2.5*
Personal consumption expenditures	*190.8*
Nondurable goods	*101.6*
Food	[1]52.2
Tobacco products	4.4
Clothing and shoes	18.7
Other (including alcoholic beverages)	[1]26.3
Services	*59.9*
Housing	18.3
Other	41.6
Durable goods	*29.2*
Automobiles and parts	12.1
Other	17.1
B. Income Account	
Gross national product	*279.8*
Minus: Business taxes, depreciation allowances, undistributed profits and other items[2]	75.6
Equals: Personal income from current production of goods and services	204.2
Plus: Government transfer payments	19.1
Equals: Total personal income	223.2
Minus: Personal taxes and related payments	20.5
Equals: Disposable personal income	*202.7*
Personal savings	11.9
Personal consumption expenditures	190.8

Source: U. S. Department of Commerce.

[1] Estimated.

[2] Includes capital consumption allowances, indirect business tax and nontax liabilities, subsidies minus current surplus of Government enterprises, corporate profits and inventory revaluation adjustment minus dividends, contributions for social insurance (included in Supplements to wages and salaries) and a statistical discrepancy.

Note: Details will not necessarily add to totals, because of rounding.

Changes in business inventories are an active element in the economy in some years. "Pipe-line" stocks of consumer durable goods were practically zero at the end of World War II, and the pressure to build up working stocks was a significant addition to the final consumer demand. At other times the change in business inventories is a surprise to businessmen themselves. It means that they have been producing or buying at a faster rate than was justified by the existing level of demand. An unplanned increase in business inventories may be followed by a sharp contraction in manufacturers' output, with a consequent reduction in employment and payrolls in the industries that are overstocked. This, in turn, depresses the demand for consumers' goods, including food.

In 1950, Government purchases and gross private investment amounted to 33 percent of the Gross National Product. The other 67 percent consisted of personal-consumption expenditures. These expenditures are divided into three broad categories. In 1950, services, including rent and utilities, amounted to 59.9 billion dollars. Expenditures for nondurable goods amounted to 101.6 billion dollars, of which about 52 billion dollars went for food. The remaining 49 or 50 billion dollars went for clothing, household textiles, fuel, tobacco, alcoholic beverages, and a wide variety of items. Expenditures for such consumers' durable goods as automobiles and household appliances reached 29.2 billion dollars in 1950.

Under peacetime conditions consumer expenditures are generally regarded as a passive element in the economy, following rather than causing changes in employment and income. Expenditures for food, clothing, and other nondurable goods seem to adapt themselves rapidly to changes in disposable income. Outlays for such services as rent and utilities change more slowly.

Expenditures for consumer durable goods normally fluctuate 1.5 to 2.0 times as much from year to year as does disposable income. In years of low employment, consumers sharply reduce their outlays for new durables and get along on what they have. Toward the top of a business cycle deferred purchases are caught up, so that the rate of new purchases in a year like 1929 (or 1950) is higher than could be maintained indefinitely even under conditions of full employment.

Although expenditures for consumer durables generally move with consumer income, the fact that they *can* be either deferred or advanced makes them a potential hot-spot in the economy. The wave of consumer buying that immediately followed ''Korea'' is a dramatic illustration. Expenditures for durable goods had been unusually large from 1947 through 1949 and many economists had expected them to slacken in 1950. Actually, the 1950 expenditures for consumer durables were up 22 percent from 1949, with the bulk of the rise concentrated in the second half of the year.

In summary, we may say that year-to-year changes in disposable income depend on the decisions of businessmen (including farm operators), the decisions of consumers, and the decisions of Federal, State, and local Governments. Ordinarily, the strategic decisions are made by business and Government. Although decisions of consumers usually follow changes in disposable income, they may become as influential as the decisions of businessmen in initiating changes at critical junctures. The ''potential'' of consumer initiative has been increased by the abnormally large holdings of liquid assets by individuals. Installment and mortgage credit give additional scope to consumer initiative in an inflationary period unless curbed by Government action.

CHANGES IN MARKETING MARGINS. — Disposable income is the chief determinant of consumer expenditures for food in retail stores and restaurants. But between consumer expenditures and cash farm income lies a vast, complex marketing system. During 1949, farmers received slightly less than 50 cents of the average dollar spent for food at retail stores. Still higher service charges were involved in food eaten at restaurants. For non-food products, as cotton, wool, and tobacco, farmers received about 15 percent of the consumer's dollar.

Marketing margins for food crops show great variation. Fresh fruits and vegetables grown locally during the summer and fall may move directly from farmers to consumers. In winter, fresh truck crops are transported long distances from such States as California, Texas, and Florida, and the freight bill takes a substantial share of the consumer's dollar.

Grain products undergo much processing between farms and consumers. A loaf of bread is a far different commodity than the pound or less of wheat which is its main ingredient. During the years between World War I and World War II farmers received for the wheat included in a loaf of bread anywhere from 7 to 19 percent of the selling price of the bread itself. Bread includes such other ingredients as sugar and fats and oils, which are also of farm origin, but 70 percent of the retail price of bread in 1949 represented baker's and retailer's charges over and above the cost of primary ingredients.

Meat-animal and poultry products have relatively high values per pound and most of them move through the marketing system in a short time. Farmers receive anywhere from 50 to 75 percent of the retail dollar spent for various food livestock products.

During the period between 1922 and 1941 a change of 1 dollar in retail food expenditures from year to year was usually associated with a change of 60 cents in farm cash receipts. But during World War II, marketing margins were limited by price-control and other measures, so that from 1940 through 1945 farm income from food products increased 78 cents for each dollar increase in their retail-store value. Following the removal of subsidies and special wartime controls in 1946, marketing margins for farm products rapidly "reflated." From 1946 to 1949 the national food marketing bill increased more than twice as much as did farm income from food products. Farmers got only 26 percent of the increase in retail food expenditures.

The mild recession of 1949 seemed to presage a return to the prewar relationship between changes in consumer food expenditures and farm cash receipts. If so, it has probably been disturbed again by the advent of mobilization and price control.

Cotton and wool are elaborately processed and may change hands several times before reaching the final consumer. The manufacturing and distributing sequence takes several months. Tobacco is stored for 1 to 3 years before manufacture. Excise taxes absorb close to 50 cents of the consumer's dollar spent for tobacco products. The marketing processes for these products are so expensive and time-consuming that short-run changes in their retail prices may show little relationship to concurrent price changes at the farm level.

GOVERNMENT PRICE SUPPORTS. — Domestic demand for such commodities as wheat, cotton, and tobacco is rather inelastic. Consumption varies little from year to year in response even to drastic changes in their farm prices. Therefore, Government loans have become extremely influential in maintaining farm income from these crops in years of large production.

Ordinarily Government price-support programs may be regarded as a passive factor in the demand for farm products, once the level of support has been prescribed by legislation or administrative decision. The loan program stands ready to absorb and hold any quantities that cannot be marketed in commercial channels, either domestic or export.[1] Government purchases under Section 32 of the Agricultural Adjustment Act have been of strategic importance in relieving temporary gluts of perishable commodities.

EXPORT DEMAND.—At first glance it might appear that the demand for our agricultural exports is completely independent of decisions made in our own country. But foreign buyers must have means of payment, typically dollars or gold. United States imports of goods and services are usually by far the largest source of such means of payment. Our imports from other countries are closely geared to the disposable income of our consumers and to the level of industrial production. Prices of industrial and agricultural raw materials usually respond sharply to increases in demand. In consequence, the total value of our imports is closely correlated with our gross national product and disposable income. During the 1920's and 1930's nearly 75 percent of the year-to-year variation in the total value of our exports was associated with changes in disposable income in the United States.

In the postwar period, loans and grants by the Government have been of tremendous importance in determining our agricultural exports. During 1949 some 60 percent of the total value of our agricultural exports was financed from appropriations for ECA and for civilian feeding in occupied countries.

There are many independent elements in the demand from abroad for our agricultural commodities. Unusually large crops in importing countries in a given year reduce their import requirements. An increase in production in other exporting countries also reduces the demand for our products. The effect of supplies in competing countries has been even more direct in the postwar years of dollar shortages than it was before World War II.

Factors Affecting Prices of Farm Products

During the last few months the author has developed statistical demand analyses for a considerable number of farm products. Practically all of these analyses are based on year-to-year changes in prices, production, disposable income, and other relevant factors, during the period between 1922 and 1941.

Price ceilings and other controls cut across these relationships during World War II and may well do so again during this mobilization period. But 1922-41 relationships are in most cases still the best bases we have for appraising short-run movements in, or pressures upon, the price structure. In practical forecasting, new elements which arise during the mobilization period must be given weight in addition to the variables included in our prewar analyses.

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[1] Subject to restrictions on eligibility for price support, such as compliance with marketing quotas or acreage allotments.

Method Used

Considerations of space make it necessary to assume that most readers are familiar with the statistical method by which the results of this section were derived. The method used was multiple regression (or correlation) analysis using the traditional least squares, single-equation approach. The recent development of a more elaborate method by the Cowles Commission of the University of Chicago necessitates a few words in explanation of the author's procedure.

In general, demand curves for farm products that are perishable and that have a single major use can be approximated by single-equation methods.[2] Most livestock products and fresh fruits and vegetables (and, pragmatically, feed grains and hay), fall in this category. Such products contribute more than half of total cash receipts from farm marketings. With other farm products—as wheat, cotton, tobacco, and fruits and vegetables for processing—two or more simultaneous relationships are involved in the determination of free-market prices. The multiple-equation approach of the Cowles Commission may be fruitful in dealing with such commodities. Even in the case of wheat or cotton, however, it is possible to approximate certain elements of the total demand structure by means of single equations.

The demand curves shown in this section have been fitted by single-equation methods after considering the conditions under which each commodity was produced and marketed. Commodities with complicated patterns of utilization have been treated partially or not at all.

The functions selected were straight lines fitted to first differences in logarithms of annual data. In most cases, retail price was taken as the dependent variable and per capita production and per capita disposable income undeflated as the major independent variables. To adapt the results to the requirements of a mobilization period in which consumption or retail price, or both, are controlled variables, per capita consumption was substituted for production in some analyses. Further adjustments were made in a few cases for the purpose of comparing net regressions of consumption upon (deflated) income with the results of family-budget studies.

The logarithmic form was chosen on the ground that price-quantity relationships in consumer demand functions were more likely to remain stable in percentage than in absolute terms when there were major changes in the general price level. First differences (year-to-year changes) were used to avoid spurious relationships due to trends and major cycles in the original variables, and for their relevance to the outlook work of the Bureau of Agricultural Economics which focuses on short-run changes.

Before World War II, commodity analysts frequently expressed the farm price of a commodity as a function of its production and some measure of consumer income. But consumers respond to retail prices. It will contribute to clear thinking if we derive one set of estimating equations relating retail prices and consumer income, and another set expressing the relationships between farm and retail prices. At certain periods, sharp readjustments may take place within the marketing system. For this reason, an equation that expresses farm price as a function of consumer income would have missed badly during 1946-49. We should not have known whether its failure was due to changes in consumer behavior or to changes in the marketing system, as both were telescoped into a single equation.

Results Obtained

FOOD LIVESTOCK PRODUCTS. — Some consumer-demand curves for livestock products are summarized in table 3. A 1-percent increase in per capita consumption of food livestock products as a group was associated with a decrease of more than 1.6 percent in the average retail price. The relationships in table 3 are based on year-to-year changes for the 1922-41 period.

Two sets of relationships are shown in the case of meat. During the early and middle 1920's we exported as much as 800 million pounds of pork in a year. The export market tended to cushion the drop in prices of meat when there was an increase in hog slaughter. As total meat production was

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[2] For a fuller treatment of this point and for a brief account of the history and present status of agricultural price analysis see the author's paper, RELATIONS BETWEEN PRICES, CONSUMPTION AND PRODUCTION, *American Statistical Association. Journal*, September 1951.

TABLE 3.—*Food livestock products: Factors affecting year-to-year changes in retail prices, United States, 1922-41*

Commodity or group	Coefficient of multiple determination[1]	Effects of one percent changes in:					
		Production or consumption[2]		Disposable income[2]		Supplies of competing commodities[2]	
		Net effect	Standard error	Net effect	Standard error	Net effect	Standard error
		Percent[3]		*Percent*[3]		*Percent*[3]	
All food livestock products[4]	.98	−1.64	(.13)	0.84	(.03)		
All meat (production)	.98	−1.07	(.07)	.86	(.07)		
Pork	.92	− .85	(.09)	.93	(.10)		
Beef	.96	− .83	(.09)	.83	(.05)	[5]—.38	(.05)
Lamb	.91	− .34*	(.15)	.78	(.07)	[5]—.40	(.11)
All meat (consumption)	.98	−1.50	(.08)	.87	(.03)		
Pork[4]	.97	−1.16	(.07)	.90	(.06)		
Beef[4]	.95	−1.06	(.12)	.88	(.06)	[6]—.52	(.09)
Lamb[4]	.94	− .50*	(.14)	.78	(.06)	[6]—.65	(.14)
Poultry and eggs:							
Chickens[4]	.86	− .75*	(.18)	.76	(.09)	[7]—.42	(.16)
Turkeys (farm price)	.90	−1.21	(.25)	1.06	(.20)	[8]—.97	(.48)
Eggs (adjusted)	.87	−2.34*	(.44)	1.34	(.13)		
Dairy products:							
Fluid milk	.87			.55	(.05)		
Evaporated milk	.84			.59	(.06)		
Cheese	.84			.77	(.08)		
Butter	.84			1.01	(.11)		

[1] Unadjusted. Represents the percentage of total year-to-year variation in retail price during 1922-41 which was ''explained'' by the combined effects of the other variables.

[2] Per capita basis.

[3] Coefficients based on first differences of logarithms. Can be used as percentages without serious bias for year-to-year changes of as much as 10 or 15 percent in each variable.

[4] Based on *consumption* per capita. Other analyses based on production per capita.

[5] Production per capita, all other meats.

[6] Consumption per capita, all other meats.

[7] Consumption per capita, all meat.

[8] Production per capita, chickens.

* Probably understates true effects of changes in production or consumption upon price.

fairly stable to begin with, small absolute changes in exports, imports, and cold-storage holdings, substantially reduced the percentage fluctuations in consumption of meat. During the 1922-41 period as a whole, meat consumption changed only about 70 percent as much from year to year as did meat production.

The first set of price-quantity coefficients for meat indicates that a 1-percent increase in meat production caused a decline of little more than 1 percent in the average retail price of meat. Increases of 1 percent in pork or beef production were associated with declines of less than 1 percent in their retail prices, and the net effect of lamb and mutton production upon the price of lamb was even smaller.

In a mobilization period the total civilian supply of meat is subject to control. The second set of meat analyses is more relevant to our current situation. A 1-percent decrease in per capita consumption of meat was associated with an increase of 1.5 percent in its average retail price.[3] A 1-percent change in the consumption of pork alone was associated with an opposite change of about 1.2 percent in its retail price. An increase in supplies of pork also had a significant depressing effect on the prices of beef and lamb.

A 1-percent increase in the consumption of beef was associated with slightly more than a 1-percent decrease in its retail price, if supplies of other meats remained constant. If the supply of other meats also increased 1 percent, the price of beef tended to decline another 0.5 percent. Supplies of beef and pork seem to have had fully as much in-

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[3] In an inflationary period, commodity prices rise more rapidly than would be indicated by prewar relationships. This does not mean that the price elasticities of demand have changed. The disturbing factors are more likely to affect the relationship between price and consumer income.

TABLE 4.—*Food livestock products: Relationships between year-to-year changes in farm price and retail price, United States, 1922-41*

Commodity or group	Coefficient of determination	Effects of 1-percent changes in: Retail price — Effect	Effects of 1-percent changes in: Retail price — Standard error	Effects of 1-percent changes in: Other factors — Net effect	Effects of 1-percent changes in: Other factors — Standard error
		Percent[1]		*Percent*[1]	
All food livestock products	.97	1.47	(.07)		
Meat animals—all	.91	1.57	(.12)		
Hogs (1)	.86	1.75	(.17)		
Hogs (2)	.87	1.35	(.44)	[2]0.28	(.29)
Beef cattle	.91	1.74	(.14)		
Lambs	.85	1.06	(.18)	[3] .26	(.05)
Poultry and eggs:					
Chickens	.93	1.35	(.09)		
Eggs	.97	1.08	(.05)		
Dairy products:					
Milk for fluid use	.93	1.64	(.11)		
Condensery milk	.79	2.13	(.27)		
Milk for cheese	.79	1.76	(.22)		
Butterfat	.95	[4]1.35	(.06)		
Creamery milk	.95	[4]1.19	(.08)	[5] .13	(.04)

[1] Coefficients based on first differences of logarithms.

[2] Wholesale price of *lard* at Chicago. Coefficient not significant owing to high intercorrelation ($r^2 = .85$) between retail price of pork and wholesale price of lard.

[3] U. S. average farm price of *wool*.

[4] Coefficient derived by algebraic linkage of two regressions: (1) Farm price upon wholesale price of butter and (2) wholesale price upon retail price. Coefficients of determination have been reduced and the standard error increased to allow for residual errors in both equations.

[5] Wholesale price of dry nonfat milk solids (average of prices for both human and animal use).

fluence on the price of lamb as did the supply of lamb itself.

Increases of 1 percent in supplies of chicken and turkey have depressed their retail prices by about the same amount. The price of chicken was significantly affected by supplies of meat, and the price of turkey was significantly affected by supplies of chicken. It is evident from these two relationships that supplies of meat were also a factor in the determination of prices for turkey. In a special analysis not shown in table 3, supplies of pork during October-December appeared to have a significant effect upon the farm price of turkeys.

The retail price of eggs responded more sharply to changes in production than did prices of any of the livestock products previously mentioned. The change of —2.3 percent (table 3) probably understates the true effect of a 1-percent change in per capita egg production. For reasons discussed later, no price-production relationships are shown for dairy products.

If we turn briefly to the price-income relationships in table 3 we find that many of the coefficients run between 0.8 and 1.0. If we had an adequate retail-price series for turkeys, the regression of retail price upon disposable income would probably be somewhat less than 1.0. Prices of eggs appeared to respond more sharply to changes in consumer income than did those of other livestock products.

There are many difficulties in price and consumption analysis for dairy products. All of these products stem from the same basic flow of milk. The fluid milksheds are only partially insulated from the effects of supplies and prices of milk in other areas. Surpluses from these milksheds are converted into manufactured products, thereby affecting prices of manufacturing milk and butterfat.

In the major manufacturing milk areas there are at least three alternative outlets for milk. Competition between condenseries, cheese factories, and creameries (including ''butter-powder'' plants), keeps prices of raw milk in the different uses approximately equal. The retail price of each product reflects the common price of manufacturing milk plus processing margins and mark-ups. Dairy products which have wide dollars-and-cents margins show a small percentage relationship between retail price and consumer income. Butter has a small processing and distributive cost relative to its value and shows a sharper ''response'' of retail price to disposable income.

Table 4 shows some relationships between year-to-year changes in retail prices and associated changes at the farm level. The coefficients are all in percentage (logarithmic) terms.

It has long been recognized that farm prices fluctuate more violently than retail prices because of the presence of fixed costs or charges in the marketing system. The coefficients in table 4 bear out this observation. Prices of livestock products as a group, during 1922-41, were approximately 1.5 times as variable (in percentages) at the farm level as at retail. The relationships for hogs, beef cattle, and for meat animals as a group ranged from 1.5 to 1.75 percent. The relationship for chickens was about 1.35 percent. The percentage change in the farm price of eggs was only slightly larger than the percentage change at retail.

Farm prices of milk and butterfat fluctuate considerably more than do retail prices of the finished products. Butter has the smallest marketing margin and the smallest percentage relationship between farm and retail price changes. The farm price of fluid milk changed about 1.6 times as sharply as the retail price and the price of milk used for cheese fluctuated about 1.8 times as much as the retail price of cheese. The price paid for milk by condenseries fluctuated more than twice as sharply as the retail price of evaporated milk, owing to the importance of fixed costs and charges in the marketing system.

At least three of the commodities listed in table 4 have important byproducts. Thus, the price of wool is a highly significant factor affecting prices received by farmers for lambs. The price of lard is a recognized factor in market prices for hogs, including price discounts for heavier animals. However, since the wholesale price of lard during 1922-41 was highly correlated with the retail price of pork, the coefficient that relates hog prices to the price of lard is not statistically significant. The price of whole milk delivered to creameries is significantly related to the price of dry nonfat milk solids, as well as to the price of butter.

Other commodities shown in the table have byproducts of some value, including hides and skins. The value of these byproducts is undoubtedly reflected in market prices to some extent and enters into the calculations of processors. But it is not always possible to measure these relationships from time series.

Table 5 summarizes relationships between farm prices, production and disposable income. In most cases the effect of a 1-percent change in production or consumption per capita is associated with more than a 1-percent change in the farm price. There is some indication that the price of hogs during April-September is less sharply affected by changes in pork production than during the heavy marketing season, October-March. Prices of eggs respond more sharply to changes in production than do prices of other livestock products. The price-quantity coefficients for individual dairy products have little significance. The regressions of consumption upon price shown in table 6 are more meaningful and are considered later.

For most livestock products the response of farm price to disposable income is more than 1 to 1. Coefficients seem to center around 1.3. Exceptions to this are prices received by farmers for all dairy products and for wholesale milk, where the coefficients are approximately 1.0.

As in table 3, supplies of competing commodities influence the farm prices of beef cattle, calves, lambs, chickens, and turkeys. The price of dry nonfat solids is again included as a factor affecting the farm price of creamery milk.

Food Crops and Miscellaneous Foods.—Table 5 also shows factors affecting farm prices of several fruits and vegetables. Prices of some of the deciduous fruits responded less than proportionately to year-to-year changes in production. The response for apples averaged —.8 percent, and for peaches (excluding California) approximately —.7. Peaches in other States are produced mainly for fresh market, whereas half or more of the California peaches are clingstone, produced for canning. In California, freestone peaches also are used extensively for canning and drying. Because of the complex utilization pattern, no single estimating equation for California peaches is likely to yield meaningful results.

Before 1936, about 90 percent of all cranberries were marketed in fresh form. Marketings were confined to the fall. A bumper crop in 1937 caused a sharp expansion in processing, and this utilization continued to increase. There is some evidence in the data for later years that the demand for cranberries has become somewhat more elastic as a result. That is, the farm price has been somewhat less responsive to changes in production than it was during the 1922-36 period. On the debit side, farm prices have been depressed in some recent years by excessive carry-overs of processed cranberries.

Prices of citrus fruits responded more than pro-

TABLE 5.—*Factors affecting year-to-year changes in farm prices, United States, 1922-41*

Commodity or group	Coefficient of multiple determination	Effect of 1-percent changes in: Production or consumption		Effect of 1-percent changes in: Disposable income		Effect of 1-percent changes in: Supplies of competing commodities	
		Net effect	Standard error	Net effect	Standard error	Net effect	Standard error
		Percent[1]		*Percent*[1]		*Percent*[1]	
			Food Livestock Products (per capita basis)				
All food livestock products[2]	.95	−2.45	(.31)	1.23	(.07)		
All meat animals (production)	.88	−1.60	(.26)	1.43	(.15)		
Hogs—cal. yr.	.82	−1.54	(.26)	1.63	(.28)		
Hogs—Oct.-Mar.	.81	−1.52	(.26)	2.08	(.28)		
Hogs—Apr.-Sept.	.69	− .99*	(.25)	1.50	(.37)		
Beef cattle	.90	−1.19	(.23)	1.27	(.13)	[3]− .40	(.15)
Veal calves	.93	− .82	(.16)	1.30	(.10)	[3]− .75	(.16)
Lambs	.87	−1.50	(.31)	1.09	(.15)	[3]− .70	(.24)
Poultry and eggs:							
Chickens	.86	− .62*	(.28)	1.06	(.12)	[4]−1.01	(.30)
Turkeys	.90	−1.21	(.25)	1.06	(.20)	[5]− .97	(.48)
Eggs (adjusted)	.82	−2.91*	(.55)	1.43	(.17)		
Dairy products:							
All	.87			.98	(.09)		
Milk, wholesale	.88			1.05	(.10)		
Milk, fluid use[6]	.91	−1.49	(.42)	.79	(.07)		
Condensery milk[6]	.76	[7]− .41	(.47)	1.34	(.19)		
Milk for cheese[6]	.71	[7]−1.01	(.59)	1.47	(.23)		
Butterfat[6]	.85	[7]−1.13	(.55)	1.28	(.15)		
Creamery milk	.79			[8]1.21	(.14)	[9] .13	(.04)
			Fruits and Vegetables (per capita basis unless otherwise noted)				
All fruits (total)	.82	− .94	(.12)	1.06	(.21)		
All deciduous fruits (total)	.82	− .68	(.09)	1.08	(.18)		
Apples (total)	.96	− .79	(.04)	1.04	(.12)		
Peaches (total)[10]	.80	− .67	(.09)	.96	(.30)		
Cranberries (1932-36)[11]	.86	−1.49	(.19)	.78	(.31)		
All citrus fruits (total)	.92	−1.32	(.10)	.98	(.20)		
Oranges	.93	−1.61	(.11)	1.34	(.25)		
Grapefruit	.72	−1.77	(.28)	1.29	(.55)		
Lemons, all	.61	−1.69	(.34)	[12] .78	(.59)		
Lemons shipped fresh:						Temperature	
Summer[13]	.79	−2.48	(.40)	1.07	(.30)	[14] .98	(.17)
Winter[13]	.88	−1.39	(.16)			[15]−1.69	(.37)
Potatoes	.93	−3.51	(.26)	1.20	(.33)		
Sweetpotatoes	.75	− .77	(.16)	.89	(.24)		
Onions:							
All[16]	.89	−2.27	(.20)	1.00	(.29)		
Late summer[16]	.85	−2.90	(.32)	[17] .72	(.60)		
Truck crops for fresh market[18]							
Calendar year (total)	.85	−1.03*	(.26)	.81	(.12)		
Winter (total)	.67	−1.13*	(.35)	.92	(.31)		
Spring (total)	.49	[17]− .95*	(.48)	.63	(.22)		
Summer (total)	.87	−1.72	(.34)	1.23	(.19)		
Fall (total)	.84	−1.67	(.35)	.85	(.20)		

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[1] Coefficients based on first differences of logarithms. [2] Consumption per capita (index). [3] Production per capita, other meats. [4] Consumption per capita, all meat. [5] Production per capita, chickens.

[6] Equations include per capita consumption of end product.

[7] These coefficients do not have "structural" significance, and two of them are statistically nonsignificant also.

[8] Coefficient obtained by algebraic linkage of three equations. Coefficient of determination reduced and standard error increased to allow (approximately) for residual errors in all three equations.

[9] Wholesale price of dry nonfat milk solids (average of prices for both human and animal use).

[10] United States, excluding California.

[11] Processing outlet expanded rapidly after 1937. There is evidence that demand is now more elastic.

[12] Nonsignificant.

[13] Adapted from analyses originally developed by George M. Kuznets and Lawrence R. Klein in "A Statistical Analysis of the Domestic Demand for Lemons, 1921-1941," Giannini Foundation of Agricultural Economics, Mimeographed Report No. 84, June 1943. Prices are measured at the f.o.b. level. The adaptations consist in (1) converting all variables into logarithmic first differences (year-to-year changes), and (2) substituting disposable personal income for nonagricultural income. The latter adjustment had little effect on the results.

[14] Index of summer temperatures in major U. S. cities (Kuznets and Klein).

[15] Index of winter temperatures in major U. S. cities (Kuznets and Klein).

[16] Analysis developed by Herbert W. Mumford, Jr. [17] Nonsignificant at 5 percent level. [18] Equations fitted to 1928-41 data only. * Probably understates true effect of production on price.

portionately to changes in production. The regression coefficients for oranges, grapefruit, and lemons, individually ranged from —1.6 to —1.8 percent. Adaptations of analyses originally developed by Kuznets and Klein suggest that prices of lemons respond much more sharply to year-to-year changes in fresh-market shipments during the summer than during the winter.

The regressions of farm prices upon disposable income center around 1.0. As in most of the analyses the price-income coefficient is not so accurately established as the price-production coefficient, little significance can be attached to deviations above or below 1.0 in the former.

Kuznets and Klein introduced an interesting feature into their analyses—an index of temperatures in major consuming centers. Temperature appears to be a highly significant factor in both summer and winter. Hot weather in the summer increases the demand for lemons in thirst-quenching drinks. On the other hand, unusually cold weather in the winter appears to increase the demand for lemons; the reputation of lemon juice as a preventive of colds may be influential.

Prices of potatoes and onions respond rather sharply to changes in production. In the prewar period, when there were no price-support programs of consequence for potatoes, a 1-percent change in potato production per capita was associated with a 3.5-percent opposite change in the U. S. farm price. Prices of the late summer crop of onions, from which most of our storage supplies come, showed a price-production response of approximately —2.9. The 12-month average price of onions indicates a less violent response to changes in production, or about —2.3.

The analyses for fresh-market truck crops are based on indices of prices and production recently developed by Herbert W. Mumford, Jr. These indices have not yet been thoroughly tested. The correlations between price and production in the summer and fall look reasonable. They indicate a price response to production of about —1.7 percent. The analyses for the winter and spring are not so accurately established. It seems probable that the true response of price to production in these seasons and for the calendar year as a whole is somewhat greater than is implied by table 5.

The regressions of farm prices of vegetables upon disposable income in table 5 center around 1.0. The standard errors of these coefficients are, in general, sufficiently large that the deviations from 1.0 are not significant.

Responses of Consumption to Price.—Table 6 summarizes responses of the consumption of various food livestock products to changes in retail price and disposable income. These coefficients are estimates of the elasticity of consumer demand. For food livestock products as a group, elasticity of demand during 1922-41 seems to have been slightly more than —.5.[4] The elasticity of demand for all meat appears to have been slightly more than —.6. Demand elasticities for individual meats, assuming that supplies of other meats remained constant, ranged from —.8 for pork and beef to at least —.9 for lamb. It is possible that the true elasticity of demand for lamb (with supplies of other meats held constant) was somewhat more than —1.0.

For certain technical reasons the elasticities of demand for chicken and turkey at retail are probably higher than the least-squares coefficients in table 6. The coefficient for turkey is based on farm prices and the response of consumption to a 1-percent change in retail price would certainly be somewhat larger. It seems probable that the elasticities of consumer demand for both chicken and turkey were not far from —1.0 during the 1922-41 period.

The elasticity of demand for eggs is estimated at —.26. It is the least elastic of the livestock products included in table 6 with the possible exception of fluid milk and butter.

The demand elasticities for individual dairy products are not so accurately established as are those for meat and poultry products. There is some evidence that the elasticity of demand for fluid milk (based on year-to-year changes) is about —.3. The elasticity of demand for evaporated milk may be as high as —1.0 although the standard error of this coefficient is fairly large. The only statistically significant coefficient obtained for butter consumption indicated a demand elasticity of about —.25 during 1922-41. Even if this result is correct it seems probable that the consumption of butter under present conditions would respond more sharply than this to changes in price. The increasing use of oleomargarine as a bread-spread is the main reason for this belief.

Table 7 summarizes coefficients for fruits and vegetables which, in general, may be taken as ap-

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[4] The words "more" or "less" applied to demand elasticities in this article refer to absolute values. In this case, the estimated elasticity is between —.5 and —.6.

Table 6.—*Food livestock products: Factors affecting year-to-year changes in per capita consumption, United States, 1922-41*

Commodity or group	Coefficient of determination	Effects of 1-percent changes in:							
		Retail price		Price of all other commodities		Disposable income[1]		Supply of competing commodities[1]	
		Net effect	Standard error	Net effect	Standard error	Net effect	Standard error	Net effect	Standard error
		Percent[2]		*Percent*[2]		*Percent*[2]		*Percent*[2]	
All food livestock products:	*Multiple*								
Actual income	.91	—.56	(.04)			0.47	(.04)		
Deflated income	.95	—.52	(.03)	[3].70	(.10)	[4] .40	(.03)		
All meat:									
Actual income	.96	—.64	(.03)			.56	(.04)		
Deflated income	.96	—.62	(.04)	[5].69	(.15)	[4] .51	(.05)		
Pork	.94	—.81	(.05)			.72	(.07)		
Beef	.86	—.79	(.09)			.73	(.08)	[6] —.41	(.09)
Lamb	.59	—.91*	(.26)			.65	(.23)	[6] —.83	(.20)
Poultry and eggs:	*Partial*								
Chicken	.54	—.72*	(.17)						
Turkey (farm price)	.74	[7] —.61*	(.13)						
Eggs	.48	[7] —.26	(.07)						
Dairy products:									
Milk for fluid use (farm price)	.44	—.30	(.08)						
Evaporated milk	.28	—.84	(.32)						
Butter	.21	[8] —.25	(.12)						

[1] Per capita basis.
[2] Coefficients based on first differences of logarithms.
[3] Special index, retail prices other than food livestock products.
[4] Disposable income deflated by retail price index.
[5] Special index, retail prices other than meat.
[6] Consumption per capita, other meats.
[7] Production per capita.
[8] Based on algebraic linkage of three equations. Elasticity of demand for butter has probably increased in recent years.
* Probably understates true effect of price upon consumption.

proximations to the elasticity of dealer demand. This is strictly true only if production and sales are exactly equal. These coefficients can also be used as a basis for estimating elasticities of demand at retail if (1) supplies actually reaching consumers are nearly equal to production and (2) if we have appropriate equations relating percentage changes in prices at retail and farm levels. If there are any fixed elements in the marketing margin, the elasticity of demand at the consumer level will be greater than at the farm price or dealer level.

The demand for apples and peaches at the farm-price level was moderately elastic, averaging about —1.2. The demand for cranberries before 1936 was moderately inelastic (about —.6). The elasticity of —1.1 for deciduous fruits as a group was a weighted average for an extremely heterogeneous group of commodities, including fruits used for processing. Apples carried a heavier weight than any other deciduous fruit and contributed largely both to the regression coefficient and to the coefficient of partial determination for the deciduous group as a whole.

Demand elasticities for individual citrus fruits at the packinghouse door appear to have ranged from —.6 down to —.3. Demands for oranges and winter lemons were the most elastic, grapefruit was of intermediate elasticity, and summer lemons had the least elasticity. Processing outlets for citrus fruits have expanded greatly over the last 15 years. Processing has extended the marketing season and increased the variety of product for each of the citrus fruits. On logical grounds, at least, this should have increased the elasticity of demand for them at the farm level. Consequently, the elasticities in table 7 should not be applied to the current situation without careful statistical and qualitative

TABLE 7.—*Fruits and vegetables: Net regressions of production upon current farm price, United States, 1922-41* [1]

Commodity or group	Coefficient of partial determination	Net regression of production upon farm price [2]	
		Coefficient	Standard error
		Percent [3]	
All fruits (total)	.77	— .82	(.11)
Deciduous fruits (total)	.76	—1.11	(.15)
Apples (total)	.96	—1.21	(.06)
Peaches [4] (total)	.79	—1.18	(.15)
Cranberries (1922-36) [5]	.85	— .57	(.07)
All citrus fruits	.91	— .69	(.05)
Oranges	.92	— .58	(.04)
Grapefruit	.70	— .40	(.06)
Lemons, all	.59	— .35	(.07)
Lemons shipped fresh:			
Summer [6]	.72	— .29	(.05)
Winter [6]	.85	— .61	(.07)
Potatoes — production	.92	— .26	(.02)
Potatoes — consumption [7]	.81	— .22	(.03)
Sweetpotatoes	.57	— .74	(.16)
Onions — all [8]	.88	—. 39	(.03)
Onions — late summer [8]	.83	— .28	(.03)
Truck crops for fresh market[9]			
Calendar year (total)	.61	— .59	(.15)
Winter (total)	.51	— .45	(.14)
Spring (total)	.28	[10] — .30	(.15)
Summer (total)	.72	— .42	(.08)
Fall (total)	.69	— .41	(.09)

[1] If consumption is nearly equal to production, these coefficients may be taken as approximations to the elasticity of *dealer* demand. Demand at the consumer level will typically be more elastic than at the farm or f.o.b. level.

[2] Production per capita unless otherwise noted.

[3] Based on first differences of logarithms.

[4] United States, excluding California.

[5] Processing expanded rapidly after 1936. There is some evidence that demand is now more elastic.

[6] Adapted from data and analyses originally developed by George M. Kuznets and Lawrence R. Klein, Giannini Foundation, 1943. (See table 5, footnote 4).

[7] Response of per capita consumption to retail price.

[8] Analysis developed by Herbert W. Mumford, Jr.

[9] Equations fitted to 1928-41 only.

[10] Unrounded coefficient not significant at 5-percent level.

study of recent experience. In particular, the phenomenal expansion of frozen concentrated orange juice since 1948 may have had a substantial effect on the elasticity of demand for oranges.

During 1922-41, the elasticity of demand for potatoes at retail seems to have been little more than —.2. The extremely inelastic demand contributes to price-support difficulties for this crop, for relatively small surpluses have a considerable depressing effect on both retail and farm prices. The elasticity of demand for onions at the farm-price level appears to have been —.3 or less for the late summer crop, and about —.4 for the year as a whole.

The elasticity of demand for sweetpotatoes is less meaningful than those for potatoes and onions. Some 50 or 60 percent of all sweetpotatoes produced are used on the farms where grown. The elasticity of market demand may be decidedly different from the production-price coefficient in table 7.

Elasticities of demand for fresh-market truck crops seem to center around —.4 at the farm-price level. These coefficients are based on indexes which include a heterogeneous group of commodities. For example, the indexes include onions for which the demand elasticity in late summer and fall was —.3 or less. Implicitly, it appears that demand elasticities for some individual truck crops may be considerably higher than —.4 if supplies of competing truck crops are held constant. The analyses for fresh-market truck crops are little more than exploratory. More detailed analyses for individual commodities will be made as time permits.

TABLE 8.—*Feed grains and hay: Factors affecting year-to-year changes in farm prices, United States, 1922-41*

Commodity	Coefficient of multiple or simple determination	Effect of changes of 1-percent in:			
		Supply factors		Demand factors	
		Net effect	Standard error	Net effect	Standard error
	Multiple	*Percent* [1]		*Percent* [1]	
Hay	.89	−1.39	(.15)	[2] 0.83	(.16)
Corn	.85	[3] −1.93	(.21)	[4] .89 [5] 2.26	(.20) (.71)
Corn	.82	[6] −1.26 [7] − .89	(.28) (.40)	[8] 1.06	(.25)
Corn	.85	[6] −1.22 [9] − .82 [10] +1.72	(.27) (.29) (1.19)	[8] .89	(.25)
		Average percent change in price associated with one percent change in price of corn			
	Simple	Percent change [1]		Standard error	
All feed grains: Prices received by farmers	.99	.91		(.02)	
Hominy feed (Chicago)	.97	.86		(.03)	
Prices paid by farmers for purchased feed	.91	.55		(.04)	
Grain sorghums	.88	.97		(.09)	
Oats	.82	.73		(.08)	
Barley	.77	.68		(.09)	
Soybean meal (Chicago)	.67	.59		(.13)	
Hay	.51	.40		(.09)	
Tankage (Chicago)	.35	.41		(.13)	

[1] Coefficients based on first differences of logarithms.

[2] Cash receipts from beef cattle and dairy products, weighted approximately in proportion to total hay consumption by each type of cattle.

[3] Total U. S. supply of corn, oats, barley and grain sorghums.

[4] Index of prices received by farmers for grain-consuming livestock (weighted according to grain requirements).

[5] Number of grain-consuming animal units on farms, January 1.

[6] U. S. supply of corn (adjusted for net changes in CCC stocks).

[7] U. S. supply of other feed grains and byproduct feeds.

[8] Product of numbers and prices of grain-consuming livestock.

[9] U. S. supply of oats, barley and grain sorghums, plus wheat and rye fed.

[10] U. S. supply of byproduct feeds. Regression coefficient is statistically nonsignificant.

An analysis of the demand for all food represents too high a degree of aggregation for most purposes. Livestock products account for more than 60 percent of the retail value of food products sold to domestic consumers and originating on farms in the United States. Consumer purchases of livestock products respond significantly to changes in price. Demand elasticities for several of these products range from −0.5 to −1.0.

The foods mainly of plant origin include some fruits and vegetables for which demand is even more elastic than the demand for meat. They also include potatoes, dry beans, cereals, sugar, and fats and oils, for which both price and income elasticities of consumption are extremely small.

Aggregative analyses of the demand for all food yield regression coefficients which are weighted averages of these diverse elasticities for individual foods. If the price of every food at retail dropped 10 percent (income remaining constant in real terms) total food consumption might increase by something like 3 to 4 percent. However, the consumption response is not independent of the distribution of price changes for individual foods if we relax the assumption of parallel price movement. A drastic decline in prices of potatoes, flour, sugar, and lard would have a negligible effect on total food consumption if prices of meats, poultry, fruits and vegetables, remained constant. On the other hand, a 10-percent drop in an index of food prices caused by a 30-percent drop in the price of meat might well lead to a 6-percent increase in an index of total food consumption.

FEED CROPS.—Table 8 summarizes some price-estimating equations for hay and corn. The U. S. average farm price of hay generally dropped about 1.4 percent in response to 1-percent increase in total supply of hay. The demand factor used in the hay analysis is an index of cash receipts from sales of dairy products and beef cattle, weighted in proportion to total hay consumption by dairy and beef cattle respectively. The price of hay changed somewhat less than proportionately to this demand index.

The first analysis shown for corn expresses corn prices as a function of total supplies of corn, oats, barley, and grain sorghums. These grains are closely substitutable for corn in most feeding uses. A 1-percent increase in total supplies of the four grains generally reduced the price of corn almost 2 percent.

Two demand factors are used in this analysis. The first is an index of prices received by farmers for livestock products, with each product weighted approximately by its grain requirements. The regression coefficient indicates that a 1-percent increase in the average price of grain-consuming livestock is associated with very nearly a 1-percent increase in the price of corn. This is consistent with the function of livestock-feed price ratios as equilibrating mechanisms for the feed-livestock economy. The second demand factor in this equation is the number of grain-consuming animal units on farms as of January 1. This coefficient is significant but is not so accurately established as the other coefficients in the equation. It implies that a 1-percent increase in grain-consuming animal units from one year to the next tends to increase corn prices by perhaps 2 percent.

The other two analyses for corn illustrate points that are sometimes overlooked in price analysis. As other feed grains are substitutable for corn the net effect of a 1-percent increase in corn supplies upon corn prices (supplies of other feeds remaining constant) is less than the effect obtained if supplies of all feed grains increase by 1 percent. The last analysis subdivides the total supply of feed concentrates into three parts. During 1922-41 the net response of corn price to corn supply was not much more than —1.2. The response of corn prices to changes in supplies of other feed grains was approximately —.8. The regression of corn prices upon supplies of byproduct feeds was positive but statistically nonsignificant. The positive sign is not wholly implausible since these feeds are used to a large extent as supplements rather than substitutes for corn.

Table 8 also summarizes some simple regression relationships between year-to-year changes in prices of other feeds and the price of corn. The level of correlation obtained is a rough indicator of the closeness of competition between the other feeds and corn on a short-run (year-to-year) basis.

Export Crops.—All of the analyses referred to in tables 3 through 8 are based on the traditional single-equation approach. This approach is not conceptually adequate to derive the complete demand structures for export crops such as wheat, cotton, and tobacco. In the absence of price supports, at least two (relatively) independent demand curves are involved in determining their prices—domestic and foreign.

It is possible, however, to get approximate estimates of the response of domestic consumption of wheat and cotton (and possibly tobacco) to changes in their farm prices. An exploratory analysis by the author yielded a demand elasticity (with respect to farm price) of —.07 (± .027) for the domestic food use of wheat. Other investigators have obtained elasticities of about —.2 (with respect to spot market prices) for the domestic mill consumption of cotton. The domestic consumption of tobacco products also appears to respond very little to changes in the farm price of tobacco.

Comparison of Time-Series Results with Family-Budget Studies

The problem of reconciling time-series and family-budget data on demand has interested economists for many years. Among other difficulties, few analysts have found sufficiently good data of both types to work with. These pages are exploratory, but they may stimulate some fruitful discussion and criticism. Space does not permit a full exposition of the methods used in this section, but a brief indication is given in table 9, footnote 1.

Table 6 contains two time-series analyses that were designed to simulate as nearly as possible the conditions prevailing in family-budget studies. One coefficient in each equation measures the relationship between consumption and real disposable income with prices of all commodities held constant by statistical means. These coefficients are compared in table 9 with corresponding family-budget regressions based on data collected by the Bureau of Human Nutrition and Home Economics in the spring of 1948. (See also table 10.)

Consumption in the time-series equation for food livestock products is measured by means of an index number. A pound of steak is weighted more heavily than a pound of hamburger and, of course, much more heavily than a pound of fluid milk. The

Table 9.—*Relationships between consumption and income as measured from time series and from family budget data, United States, 1922-41 and 1948*

Item	Net effect of 1-percent change in per capita income upon:		
	Consumption per capita (time series data, 1922-41)	Expenditure per capita[1] (family budget data, spring 1948)	Quantity purchased per capita[1] (family budget data, spring 1948)
	Percent	*Percent*	*Percent*
All food livestock products	0.40 [2] (.03)	0.33	0.23
All meat	.51 [2] (.05)	[3] .36	.23

[1] See table 10, footnote 2. A fuller statement of the methods used to obtain these coefficients will be supplied on request.

[2] Standard error of time series coefficient. Comparable measures for the family budget coefficients are not available, as the coefficients were calculated from grouped data.

[3] Meat, poultry, and fish. Coefficient for meat alone would be slightly higher.

weights are average retail prices in 1935-39. Hence the time-series regression implies that if all prices are held constant, *expenditures* will increase with income in the proportions indicated.

Conversely, the expenditures shown in family-budget data are analogous to price-weighted indexes. As the price of each type, cut, and grade of product is the same to consumers of all income groups during the week of the survey, expenditures for livestock products at two family-income levels are equal to the different quantities bought, multiplied by the same fixed prices.

Consumption in the time-series analysis for meat is measured in pounds (carcass-weight equivalent) but each ''pound'' is a composite of all species, grades, and cuts. Expenditures at constant prices will change almost exactly in proportion to these ''statistical pounds.'' But the actual pounds shown in family-budget data reflect more expensive cuts and grades at high- than at low-income levels. In the 1948 study, average prices per pound paid by the highest income group exceeded those paid by the lowest in the following ratios: All beef, 34 percent; all pork, 28 percent; all meat, 35 percent; meat, poultry, and fish combined, 32 percent. On the average, a pound of meat (retail weight) bought by a high-income family represented a greater demand upon agricultural resources than a pound of meat bought by a low-income family.

There are strong arguments for comparing the expenditure-income regressions from family-budget data with the consumption-income regressions from time series. The coefficients are not unduly far apart, considering the possible factors that make for differences. Among other things, 1948 was a year of full employment. As the income elasticity of food consumption decreases at higher family-income levels, and as the family-budget observations have been weighted according to the high-income pattern of 1948, the regression coefficients in table 10 are probably lower than would have been obtained on the average during 1922-41.

Some internal features of the family-budget data for 1948 deserve comment. In the case of livestock products the expenditure coefficients more nearly reflect demands upon agriculture (hence, real income to agriculture) than do the quantity coefficients. The differences between the two sets of coefficients are largely due to differences in type and quality of products consumed, with the significant aspects of quality being reflected back to farmers in the form of higher farm values per retail pound.

The situation with respect to two of the fruit and vegetable categories seems to be similar to that of livestock products (table 10). The difference between expenditure and quantity coefficients probably reflects increasing use of the more expensive types and qualities within each commodity group. The higher income families may be paying more for marketing services, but they are also paying more per pound to the farmer.

This is only partly true in the ''other foods'' group. *Grains* at the farm level are fairly homogenous. The difference between expenditure and quantity regressions for grain products must largely reflect differences in marketing services (baked goods versus flour, and so forth). *Sugars* and *sweets* include candy, soft drinks, and preserves, and sugars and sirups. To the extent that candy includes domestically produced nuts, or that preserves include domestic fruits and berries, the positive expenditure coefficient indicates some benefits to farmers. But most of the difference between expenditure and quantity regressions for sweets goes to bottlers, confectioners, and distributors.

The positive expenditure coefficient for *fats* and *oils* is mainly due to the greater use of butter by the higher income groups. Because of this fact, the expenditure coefficient more nearly represents the demand for agricultural resources in the produc-

TABLE 10.—*Food expenditures and quantities purchased: Average percentage relationship to family income, urban families, United States, spring 1948*

Item	Relative importance[1] (1)	Effect of one-percent change in income upon:		
		Expenditure (2)	Quantity purchased (3)	Col. (2) minus Col. (3) (4)
		Percent[2]	*Percent*[2]	*Percent*[2]
A. Per family:				
All food expenditures		*0.51*		
At home		.40		
Away from home		1.12		
B. Per family member:[3]				
All food expenditures		*.42*		
At home		.29		
Away from home		1.14		
C. Per 21 meals at home:[3]				
All food (excluding accessories)	*100.0*	*.28*	[4]*0.14*	*0.14*
All livestock products	*50.8*	*.33*	[4] *.23*	*.10*
Meat, poultry and fish	29.2	.36	.23	.13
Dairy products (excluding butter)	16.9	.32	.23	.09
Eggs	4.7	.22	.20	.02
Fruits and vegetables	*19.0*	*.42*	[4] *.33*	*.09*
Leafy, green and yellow vegetables	4.9	.37	.21	.16
Citrus fruit and tomatoes	5.2	.41	.42	— .01
Other vegetables and fruits	8.9	.45	.35	.10
Other foods	*30.2*	*.08*	[4]— *.12*	*.20*
Grain products	11.4	.02	— .21	.23
Fats and oils	9.8	.13	— .04	.17
Sugars and sweets	5.2	.20	— .07	.27
Dry beans, peas and nuts	1.5	— .07	— .33	.26
Potatoes and sweetpotatoes	2.3	.05	— .05	.10

[1] Percent of total expenditures for food used at home, excluding condiments, coffee, and alcoholic beverages.

[2] Regression coefficients based upon logarithms of food expenditures or quantities purchased per 21 meals at home and logarithms of estimated Spring 1948 disposable incomes per family member, weighted by proportion of total families falling in each family income group. The object was to obtain coefficients reasonably comparable with those derived from time series.

[3] Per capita regression coefficients are lower than per family coefficients in this study whenever the latter are less than 1.0. This happens because average family size was positively correlated with family income among the survey group. A technical demonstration of this point will be supplied on request.

[4] Weighted averages of quantity-income coefficients for subgroups.

Basic data from UNITED STATES BUREAU OF HUMAN NUTRITION AND HOME ECONOMICS. 1948 FOOD CONSUMPTION SURVEYS. PRELIMINARY REPT. No. 5, May 30, 1949; tables 1 and 3.

tion of fats and oils. In the group comprising dry beans, peas, and nuts, the first two decline rapidly and the third increases rapidly as family income rises, so the expenditure regression is more relevant to farm income than is the quantity coefficient.

For all foods (excluding condiments, alcoholic beverages, and coffee) the 1948 survey of BHNHE indicates a tendency for expenditures per 21 meals at home to rise about 28 percent as much as family income per member. The weighted average of the quantity-income regressions is about 14 percent. One-fourth, or one-third, of the difference probably goes to marketing services. On balance, it appears that, in 1948, a 10-percent difference in income per family member meant a difference of roughly 2.5 percent in the per capita demand for agricultural resources used in food production.

This effect was a weighted average of 3.3 percent for livestock products, 4.2 percent for fruits and vegetables other than potatoes, and *slightly less than zero* for other foods as a group. These coefficients indicate the direction in which consumers tend to adjust their food patterns as their incomes increase. At present, per capita consumption of grain products and potatoes is 15 percent lower than in 1935-39. The demand for spreads for bread has also been caught in this downtrend, so that the per capita consumption of butter and oleomargarine combined in 1950 was 3 pounds, or 15 percent, below the prewar average. Consumption of sugar and total food fats and oils per person was about the same in 1950 as in 1935-39. On the other hand, per capita consumption of livestock products (excluding butter and lard) was up more than 23 percent and consumption of fruits and vegetables (aside from potatoes and sweetpotatoes) was up 9 percent.

Two other points might be noted in closing: (1) The regression of *calories* upon income per family member is somewhat less than the average quantity gradient of 14 percent would suggest, as costs per calorie are considerably lower for sugar, fats and oils, and grain products, than for livestock products and fruits and vegetables; (2) the demand for *restaurant meals* seems to increase slightly more than 10 percent in response to a 10-percent increase in income per family member. This implies, of course, a similar increase in demand for restaurant services.

Economic Research in Farm Electrification

By Joe F. Davis

Farm electrification has become a major economic development in American agriculture. Studies of the uses that farmers are making of electric power have been completed or are in progress in nine areas from Georgia to Washington State. Preliminary comparisons of the findings in different areas are here reported and interpreted. (The research on which this article is based was financed in part with funds provided by the Research and Marketing Act of 1946.)

FIFTEEN YEARS AGO about 800,000 farms in the United States had electric service from central-station sources. By June 30 last year more than 5,000,000 or about 86 percent of all farms had this service.

Widespread use of electric power in rural areas has created a multitude of problems that are still with us. They are of concern both to farmers and to those in the service fields. Farmers need guidance on ways to use the power profitably, on the kinds of equipment to install, and on problems of farmstead wiring. Suppliers of electricity want a firm basis for estimating the probable future use of electricity on farms as a guide for the installation of adequate service facilities and for the establishment of rate schedules. The public too is concerned with various aspects — lending activities, utility regulations, research, teaching.

Economic research in this field was begun by the Bureau of Agricultural Economics in 1948 with the cooperation of State agricultural experiment stations. The Rural Electrification Administration and other governmental agencies have given valuable assistance in certain aspects of the work. At the outset two principal objectives were envisioned. First, to establish criteria that would be useful in estimating the probable future use of electricity on farms. Second, to study the place of electricity in the whole scheme of farm mechanization — to appraise its usefulness in reducing costs and in increasing labor efficiency on farms.

How the Studies Were Made

STUDY AREAS.—The work was begun by initiating a series of surveys in the principal type-of-farming areas of the country. Field work for nine surveys has been completed. Reports for three of these have been published—for a dairy and poultry area of northwestern Washington (USDA, FM 77), a general livestock area of eastern Iowa (USDA Circular 852) and an old cotton area in the Upper Piedmont of Georgia (Georgia Experiment Station Bulletin 263). Analyses of the data from the other 6 surveys are in various stages of progress. These surveys were made in the winter-wheat belt of southwestern Kansas, the general-farming area of the East Tennessee Valley of Tennessee, the wheat-producing area of eastern Washington, the Clay

Hills area of Mississippi — mostly small cotton farms, the spring wheat area of north-central North Dakota, and the eastern dairy area of Wisconsin.

A study area usually consists of a type-of-farming area within a State. Most of them were from 9 to 20 counties in size and included from 5,000 to 50,000 farms having central-station electric service.

Several considerations entered into the selection of the study areas. For one thing it was desired that each be somewhat representative of a much larger area. For another, the act that authorized the funds stipulated the cooperation of the State agricultural experiment stations. It was necessary, therefore, to find States that had an interest in the work and that had some resources to put into it. Another was that information from both the farmer and his supplier of electricity was necessary. It seemed desirable to hold to a minimum the number to be interviewed so that time and costs of travel would not be excessive. A further consideration was to select an area where a number of farmers had received the service for a sufficiently long period to show trends in usage.

The Sample.—The samples ranged in size from 300 to 600 farms, or about 2 percent of the electrified farms in the respective study areas. In most of the areas the samples were selected by the random block method.

Field Administration.—In general, this scheme of sampling proved highly satisfactory. In the management of the field work the maps served two useful and unanticipated purposes. First, they helped to get the confidence of the respondents. Some farmers seemed to be suspicious of the whole proceeding and asked, "Why did you pick me out?" The enumerator would take the map, explain the sampling procedure, point out the dot representing the farmer's home and indicate neighboring farms to be visited. Few farmers remained uncooperative. The general feeling of the enumerators was that the maps helped in keeping the number of refusals exceedingly low.

The second function was to help identify the farm at the power supplier's office. Suppliers frequently carried the account in a name other than that of the operator—a relative, the land owner, or someone else. By comparing the sampling map with the supplier's system map, the farms usually could be identified positively. Few farm schedules were discarded because of failure to match the farm and the supplier's record.

Two problems, one of which stemmed from the sample, plagued the field parties. The culture maps on which the sampling segments were based were 10 years old or older. Some segments might have 4 or 5 farms according to the map but were found to be filled with a dozen or more rural residences. This condition was fairly common in the areas in Georgia and Tennessee. But in North Dakota and Kansas the opposite situation was found. Many farmsteads indicated on the maps were vacant or had been destroyed. Such conditions made it difficult to keep the sample of the desired size and to keep it representative of all the electrified farms in the study area.

The second problem concerned the identification of the farm and the farm headquarters. A common situation was a farm with two dwellings. One would be occupied by the owner who was gradually retiring from the operation of the farm. The other dwelling would be occupied by a son or some other person who made some of the decisions regarding management. The problem is, at what point in the retirement process does the owner cease to be the operator and become a rural resident instead? Or should there be another tenure classification for those farms that are neither clearly owner-operated nor clearly tenant-operated? This problem is not unique with these surveys but it appears to be intensifying as more and more farmers are retiring on their farms.

The Enumeration. — Most of the enumerators were students, graduate and undergraduate, at the respective State agricultural colleges. Most of them were majoring in either agricultural economics or agricultural engineering. Although they were competent enumerators, the usual procedure of close supervision by technicians of the Bureau of Agricultural Economics and the State agricultural experiment station was followed.

The time required to take a farm schedule varied from about 15 minutes to 1 hour or more, depending upon the complexity of the farm organization, the electrical equipment used, and the responsiveness of the farmer.

Farmers in general were enthusiastic about electricity and willing to take time to talk about it. The suppliers of electricity also were cooperative. They went to trouble and expense to provide data on consumption and cost for the individual farms —and did it without cost to the project.

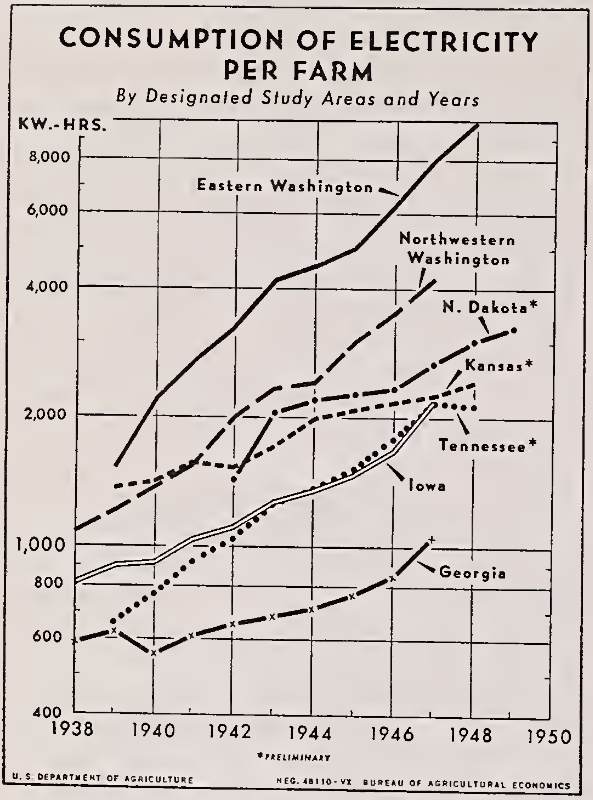

FIGURE 1.

Some Basic Findings

CONTINUALLY INCREASING USE. — In each of the study areas consumption records were obtained for the preceding 10 years, or for such part of that period as the farm was electrified and the records were available. In each of the areas the average consumption was considerably higher at the end of the period than at the beginning. And in most of them the increases were at a geometric rate (fig. 1). In eastern Washington the increase was at the rate of almost 21 percent a year. In the Kansas area average consumption increased at a rate of more than 7 percent annually. In most other areas the rates of increase fell between these extremes.

No indication was evident of a leveling off in the use of electricity even among farms that had been electrified for 20 years or more. Farmers continue to install milking machines, pig brooders, chick brooders, shop tools, and other equipment to reduce the costs of production and to increase the labor efficiency on farms. And just as rapidly they are installing water systems, automatic water heaters, refrigerators, food freezers, and other equipment to ease the work of the homemaker.

ELECTRICITY IN FARMING OPERATIONS.—Wide variations were found among the study areas both in the total amount of electricity used and in the specific applications made of it. One of the causes was the differing needs for various kinds of equipment in farming operations. The dairy and poultry enterprises, in particular, have a number of jobs that are well suited to the use of electricity and electrical equipment. Consequently these two are the most highly electrified of the principal enterprises of the farm.

The use of electricity per farm for farming operations alone was more than 1,300 kilowatt-hours in the northwestern Washington area for the year 1947. Eighty percent of this was used in the dairy and poultry enterprises. In contrast, farmers in southwestern Kansas used about 240 kilowatt-hours per farm for farming, in 1948. These were mainly grain farms; they had more need for shop tools but the energy required to operate them was less than that needed for the dairy equipment in the Washington area.

In all of the study areas the bulk of the electricity has been used for household rather than for farm operations. In the northwestern Washington area almost 70 percent of all the electricity consumed by farms in 1947 was for household use. In other areas between 80 and 90 percent was used in the farm homes. The small farms with few livestock or poultry used even larger than average proportions in their homes (table 1).

ELECTRICITY AND GAS COMPETE.—Another cause of differences among areas was the competition between electricity and gas (usually a liquefied petroleum gas) as a source of heat for cooking and water heating. Large amounts of energy are required for these two purposes. In the Iowa area water heaters (household) and kitchen ranges accounted for more than one-third of all the electricity used on the farms. In the northwestern area these two pieces of equipment used almost one-fourth of the total.

Competition between electricity and gas for these purposes varied widely among the areas. In the Tennessee area, where electric rates were relatively low, only 1 gas range and 1 gas water heater were reported on the 492 farms. There were 163 electric ranges and 86 electric water heaters. But in the Kansas area, where gas was more plentiful, 65 percent of the ranges and 45 percent of the water heaters burned gas while 25 percent of the

TABLE 1.—*Electricity used per farm and percentage used for farming operations, by income groups, specified areas and years (preliminary)*

Study area in	Year	Income group							
		Low		Medium		High		All farms	
		Electricity used	Proportion for farm operations	Electricity used	Proportion for farm operations	Electricity used	Proportion for farm operations	Electricity used	Proportion for farm operations
		Kw.-hrs.	*Percent*	*Kw.-hrs.*	*Percent*	*Kw.-hrs.*	*Percent*	*Kw.-hrs.*	*Percent*
Eastern Iowa[1]	1947	1,295	12.4	2,170	22.6	3,491	19.7	2,174	19.6
Georgia Piedmont[2]	1947	660	3.0	780	6.0	1,977	16.7	1,050	11.3
Northwestern Washington[4]	1947	2,982	22.0	5,817	37.8	10,549	44.4	4,240	31.1
Southwestern Kansas[1]	1948	1,658	8.5	2,414	11.5	3,349	10.9	2,428	10.0
Eastern Washington[4]	1948	6,720	7.1	10,292	8.2	15,147	7.1	9,845	7.8
East Tennessee Valley[3]	1948	1,048	2.6	1,404	4.5	4,971	20.0	2,139	10.6
North Central North Dakota[1]	1949	2,350	15.6	3,094	12.5	5,543	13.6	3,276	13.4

[1] Under $6,000; $6,000 to $14,999; and $15,000 and over.

[2] Under $2,000; $2,000 to $3,900; and $4,000 and over.

[3] Under $1,500; $1,500 to $4,900; and $5,000 and over.

[4] Small, medium, and large farm classification closely approximating low, medium, and high income groupings for those areas.

ranges and 46 percent of the water heaters used electricity. Had these gas ranges and water heaters used electricity, the average consumption of electricity by all farms in the Kansas area would have been 63 percent greater than it was.

It is evident that the quality of service given the farmers and the rates charged for electricity influence the uses made of it on farms. In some areas the installation of electrical equipment has been restricted considerably because of unsatisfactory service. These are subjects that deserve further investigation.

COSTS AND INCOMES.—The average cost of electricity to the farmer ranged from 0.5 percent of his gross income (both farm and nonfarm) in the eastern Washington area to 1.6 percent in the eastern Tennessee area. The actual annual cost ranged from $157.59 in the eastern Washington area to $36.37 in the Upper Piedmont of Georgia (table 2). This does not appear to be a heavy burden but it bore more heavily on the low-income farmers than on those with high incomes. In none of the 7 study areas did the electric bill of the high-income farms amount to 1 percent of their total incomes. But in 4 of them the low-income farms paid out more than 2 percent of their total incomes for the electricity they used. In the Georgia area, in 1947, about 75 percent of the low-consuming farms used 35 percent of the total kilowatt-hours and paid 53 percent of the bill; but 11 percent of the farms that used the most electricity consumed 47 percent of the total kilowatt-hours and paid 28 percent of the bill.[1]

It should be pointed out that the cost of electricity is not necessarily a new cost borne by the farmer. For many purposes electricity is a replacement for other forms of energy, animate and inanimate, previously used. The costs of alternatives have not yet been studied.

In each of the areas for which data are available, the high-income farms used more electricity than did those with low incomes. They had more occupied dwellings per farm, more service buildings, livestock, and machinery and so more need for electrical equipment. Furthermore, they were better able to finance the costs of the equipment and the costs of its installation. In fact, these costs may be more influential than the cost of the electric bill in restricting the use of this form of power.

To illustrate, the cost of electricity to operate an electric pump used in connection with a water system probably averages less than a dollar a month. This is not a large sum for most farmers. But the cost of installing a complete water system and equipment in most farm homes is considerable. In addition, many farm dwellings are so constructed that water pipes in them would freeze in severe weather. To insulate the dwellings would be difficult and expensive. Many of the farmers said that they would not install a water system until they built a new dwelling.

EFFECT OF ELECTRIFICATION ON FARM OPERATIONS.—In each of the surveys the farmers were asked about changes in their farm production or

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[1] Georgia Experiment Station Bulletin 263, p. 56.

TABLE 2.—*Average annual cost of electricity per farm and per $1,000 total income, by income groups, specified areas and years (preliminary)*

Study area in	Year	Income group[1]							
		Low		Medium		High		All farms	
		Total cost	Cost per $1,000 total income	Total cost	Cost per $1,000 total income	Total cost	Cost per $1,000 total income	Total cost	Cost per $1,000 total income
		Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Eastern Iowa	1947	60.66	15.86	78.84	8.05	105.81	4.56	78.81	7.36
Georgia Piedmont	1947	27.41	22.11	31.37	11.10	55.31	8.47	36.37	10.22
Northwestern Washington[1]	1947	52.17	10.83	80.57	9.06	132.55	5.33	65.19	6.15
Southwestern Kansas	1948	84.99	33.34	96.41	9.80	109.43	4.42	98.48	8.21
Eastern Washington[1]	1948	123.23	7.30	156.68	5.17	228.96	3.45	157.59	4.98
East Tennessee Valley	1948	26.79	24.16	35.43	18.16	73.04	5.61	42.63	16.11
North Central North Dakota	1949	105.72	25.68	122.92	13.49	177.43	8.48	126.99	12.41

[1] See footnotes table 1.

changes in their labor requirements attributable wholly or in part to the use of electrical equipment. In general, the answers were qualitative rather than quantitative.

Some dairy farmers gave definite replies. The milking machine saved so many hours of work a day. Or the milk cooler and water heater facilitated improvements in sanitation so that the farmer could sell grade A instead of grade B milk. Or the equipment enabled him to handle more cows. Some farmers talked about more pigs raised per litter or earlier farrowing dates through the use of electric pig brooders. Others mentioned labor savings and more chicks raised because of electric chick brooders.

Most farmers, however, would say "It makes a lot of difference," or "It saves a heap of time," or something similar. They thought they could not be more specific.

The reason seems to be that on most farms electricity seeps rather than surges into the farm organization. A farmer first has lights in the service buildings and service areas. A little later he installs something more—possibly an electrically operated pump jack—then a tool grinder—then a chick brooder—and so on. The effect of each individual use may be too small to measure accurately but the aggregate effect of all of them is decidedly significant on many farms. Electric power clearly has been instrumental in reducing labor requirements in American agriculture.

A pilot study to appraise the role of electricity in the organization and operation of farms is being made with the cooperation of the Iowa Agricultural Experiment Station. It is expected that a preliminary report will soon be available.

The social consequences of farm electrification, profound though they are, have not been studied.

Prospects for Increased Use

These studies indicate that the use of electricity on farms is still in its infancy. Farmers are bound to buy more equipment for use in both household and farm operations. Home (food) freezers, television sets, air-conditioning units, water systems, pumps for supplemental irrigation, chick brooders, dairy equipment of various kinds, and a wide variety of other equipment, are expected to augment the farm demand for electricity.

Within another 10 years or so the use of electricity per farm may easily be double what it was at the time of the surveys in these areas. Total use by all farms certainly will increase even more because of the extension of power lines to additional farms. These estimates are based upon an analysis of the rates at which specific kinds of equipment have been installed by farmers in the past and on estimates of additional equipment that probably will be installed during the coming decade. It is assumed that power available to the farmers will be adequate and dependable, that equipment will be in ample supply, and that farm incomes will remain at a reasonably high level.

Equipment to be bought will vary with the needs of the farms in the different areas. For example, water pumps for supplemental irrigation are expected to be important in increasing the use of electricity in the northwestern Washington area. But in the Upper Piedmont of Georgia household equipment is expected to be bought most often.

A Study of Recent Relationships Between Income and Food Expenditures

By Marguerite C. Burk

Postwar variations from prewar levels in income, expenditures, and prices have necessitated the reconsideration and re-evaluation of our ideas of consumer demand for food. The Bureau of Agricultural Economics has been devoting attention to the improvement of food consumption data and analyses, particularly those which are useful in forecasting demand in terms of quantities and prices. This article, prepared under the Agricultural Research and Marketing Act of 1946, analyzes relationships between food expenditures and income, including an appraisal of the static and dynamic forces involved.

AT FIRST GLANCE, data on food expenditures and income in the United States in the past 20 years indicate that a larger proportion of income has been spent for food in this postwar period of record high incomes than in less prosperous years. This is contrary to what one would expect on the basis of Engel's famous law and the results of many studies of family expenditures. Engel's law is generally remembered as stating that families with higher incomes spend a smaller proportion of their incomes for such necessities as food than do families with smaller incomes. If that is true of individual families, should it not hold for national averages? But can Engel's law be applied to historical comparisons of national averages? If it can be, what is the explanation of the apparent contradiction in the postwar period?

The analysis of the problem posed by these questions will proceed in five steps. First, we shall point out the principal differences between the static and dynamic aspects of the problem of income-food expenditure relationships. Second, we shall review information on family food expenditures and income taken from sample surveys, often called family-budget data. These are similar to the data collected by Engel, and each survey reflects an essentially static situation. Third, a set of data on food expenditures and income will be developed under partly static and partly dynamic concepts; that is, including changes in the food consumption pattern and income through time, but excluding changes in the price level, in relative prices, and excluding major shifts in marketing. Fourth, we shall arrive at a fully dynamic situation by adding price changes to the set of data developed in the preceding section, then by making certain adjustments in the Department of Commerce food expenditure series and in the Department of Agriculture series on the retail cost of farm food products, and then comparing the results with disposable income per capita. The pattern of these comparisons will be examined to learn whether, through time, there is a strong tendency of income-food expenditure relationships to adhere to the static pattern, that is, to follow Engel's law. Finally, the postwar situation will be analyzed to ascertain the extent to which the variation of income-food expenditure relationships in 1947-50 from the prewar pattern reflects either temporary aberrations in the underlying pattern, or an enduring shift in relationships which may or may not still evidence the pattern predicated by Engel's law.

Obviously, the average proportion of income spent for food in the entire country is a weighted average of the income-expenditure relationships of all families and individuals, from the lowest to the highest incomes. But the comparison of the average proportion of income spent for food in the United States over several years involves a shift from a static to a dynamic concept and introduces a new complex of factors.

Let us begin by recalling the circumstances under which Engel developed his law. Ernst Engel studied the expenditures of families of all levels of income in Belgium and Saxony, in the middle of the nineteenth century. His data showed a consistently higher percentage of total expenditures going for food coincident with lower average incomes per family. He concluded, "The poorer a family, the greater the proportion of the total out-go that must be used for food.''[1] It is to be noted that Engel's analysis was confined to one period in time. The data on food expenditures which he examined included costs of alcoholic beverages, and the food purchases were almost entirely for home consumption. Furthermore, food commodities in that century were not the heterogeneous commodities they are today. Families bought raw food from rather simple shops or local producers and did most of the processing at home. Their food expenditures did not include such costs as labor and cooking facilities in the homes. Now, families have a wide choice of kinds of places to buy their food, of many more foods both in and out of season, of foods extensively processed into ready-to-serve dishes, and of eating in many kinds of restaurants. Accordingly, families of higher income now may spend as large a proportion of their incomes as lower income families, or even a larger proportion, by buying food of better quality, expensively processed, and with many marketing services.

Such developments in food commodities and marketing might be expected to affect income-food expenditure relationships over time in the same way as at a particular period. Numerous other factors are present in the dynamic situation which do not enter into the problem at a given period and given place, although they are significant in place-to-place comparisons, which are considered only incidentally in this study. These dynamic factors include changes in the average level of income, distribution of income, the geographic location and the composition of the population, relative supplies of food and nonfood commodities, and changes in both the general price level and relative prices, and also changes in the manner of living that are independent of income. With these factors in mind, we shall examine income-food expenditure relationships of aggregate data for a 20-year period to learn whether there is a pattern and to what extent economic and social disturbances have caused variations from that pattern.

Survey Data on Income-Food Expenditure Relationships

Data on food expenditures and incomes in this country are of two types: (1) information on family-food expenditures taken from sample surveys, often called family-budget data, similar to those collected by Engel and essentially static in character and (2) aggregate time-series data such as those of the Department of Commerce and the Department of Agriculture. The survey data here used were obtained from reports by individuals and families, as those of the *1935-36 Consumer Purchases Study,* the *1941 Study of Spending and Saving in Wartime,* and the *1948 Food Consumption Surveys* (urban). These data must be handled cautiously and they require many adjustments before they can be compared.[2]

For purposes of analysis, approximations can be made to meet most of the problems inherent in the data except that of consistent under-reporting of expenditures for snacks and meals away from home and for beverages. However, value of food consumed at home appears to be somewhat high in the aggregate and presumably offsets this underreporting to a considerable but unknown extent.[3] As the underreporting of such expenditures is likely to be greater in the higher income groups than in the lower, the income-elasticity of demand derived from reported data is probably understated.

Table 1 contains the data on food and beverage expenditures for the whole population derived by the author from the 1935-36 and 1941 surveys, as well as roughly comparable data on total consumer disposable income per person, the proportion thereof being used for such expenditures, and average food and beverage expenditures per person. Several observations are in order at this point. Comparison of the percentages spent for food in the two studies can be made, although there was a

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[1] Translated from page 26—DIE LEBENSKOSTEN BELGISCHER ARBEITER-FAMILIEN FRÜHER UND JETZT—ERMITTELT AUS FAMILIEN-HAUSHALTSRECHNUNGEN. Inst. Internatl. Statis. Bul. 9: 1-124. illus. 1895.

[2] Numerous references to their limitations can be found in the literature. One of the best articles is by DOROTHY S. BRADY and FAITH M. WILLIAMS. ADVANCES IN THE TECHNIQUES OF MEASURING AND ESTIMATING CONSUMER EXPENDITURES. Jour. Farm Econ. Vol. 27:2:315-44. May 1945. Others are the papers by SELMA GOLDSMITH in Volume 13 of the STUDIES IN INCOME AND WEALTH, issued by the NATIONAL BUREAU OF ECONOMIC RESEARCH, and by STANLEY LEBERGOTT before the American Statistical Association, 1949, unpublished, and Part II, FAMILY SPENDING AND SAVING IN WARTIME, Bulletin No. 822, UNITED STATES DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS, 1945.

[3] For example, expenditures for alcoholic beverages reported in the 1941 study averaged only a little over $7 per person, whereas the Department of Commerce estimate of such expenditures in 1941 is about $32 per capita. Data from the same survey on expenditures for food away from home yield an average of $22 per person, but an estimate derived from Commerce data for the same year totals $30. On the other hand, food consumed at home, including home-produced foods, was valued at $156 per person. After making adjustments in Commerce data to bring them to the same price level, the average was only $133 per capita.

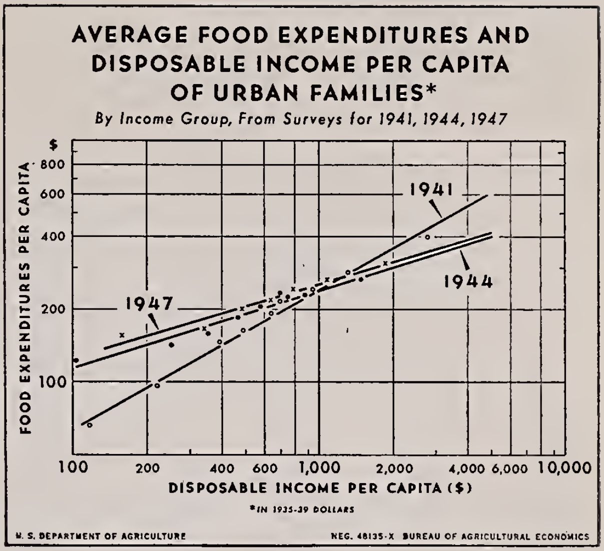
TABLE 1.—*Average disposable income and food expenditure per capita, and proportion of income spent for food, by income group, 1935-36 and 1941*[1]

Total income per consumer unit[2]	Average disposable income per capita in current dollars	Food expenditures per capita: Average in current dollars	Food expenditures per capita: Percentage of disposable income
	Dollars	*Dollars*	*Percent*
		1935-36	
Under $500	113	69	61
$500 to 999	242	104	43
1,000 to 1,499	370	132	36
1,500 to 1,999	502	154	31
2,000 to 2,999	679	179	26
3,000 to 4,999	982	209	21
5,000 and over	3,270	344	11
Average	462	134	29
		1941	
Under $500	122	91	75
$500 to 999	293	130	44
1,000 to 1,499	446	167	37
1,500 to 1,999	529	179	34
2,000 to 2,999	734	206	28
3,000 to 4,999	1,008	247	24
5,000 and over	2,027	354	18
Average	680	191	28

[1] Data derived by author from 1935-36 CONSUMER INCOME AND EXPENDITURE STUDIES of the NATIONAL RESOURCES COMMITTEE and 1941 STUDY OF SPENDING AND SAVING IN WARTIME. Disposable income includes money and non-money incomes; 1941 incomes adjusted for underreporting. Food expenditures include expenditures for alcoholic beverages and for food away from home, and home-produced food valued at local prices. All data exclude residents of institutions.

[2] Approximates disposable income.

small difference in the price level between the two surveys and some redistribution of incomes in the two open-end groups. There seems to have been remarkable stability in the relationships of all but the highest and lowest income groups. The income elasticities of the two sets of data are fairly similar.[4] Engel's law is certainly borne out in each of these sets of data. The single-point difference between the average proportions of income spent for food in 1935-36 and 1941 precludes using these data for argument for or against the application of Engel's law through time.


AVERAGE FOOD EXPENDITURES AND DISPOSABLE INCOME PER CAPITA OF URBAN FAMILIES*

By Income Group, From Surveys for 1941, 1944, 1947

*IN 1935-39 DOLLARS

U. S. DEPARTMENT OF AGRICULTURE NEG. 48135-X BUREAU OF AGRICULTURAL ECONOMICS

FIGURE 1.

The income elasticities derived from the 1941 data on urban families' incomes and food expenditures and from comparable 1947 data reported in the 1948 spring survey, are significantly different —0.58 for the former and 0.31 for the latter. As a check, a similar analysis of the study for 1944 by the Bureau of Labor Statistics[5] was made, yielding a 0.33. The data from these studies have been plotted on figure 1 in terms of constant 1935-39 dollars. The differences in the slopes of the three lines, which were fitted by least squares, indicate the differences in average income elasticity of food expenditures. Analysis of the possible causes for such differences will follow in the last section of this article.

Static-Dynamic Situation

Although Engel's law of food expenditures is directly applicable only to the static situation described above, it seems logical that it should be reflected to some extent in a dynamic economy by time-series data on national income and food expenditures. We investigate this possibility by constructing a time series to match most of the basic concepts of the family-budget data.

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[4] The regression lines fitted to the logarithms of average expenditures per person, for food and alcoholic beverages, money and non-money, against logarithms of average total disposable income per person, all in current dollars, are for 1935-36, $Y' = .88 + .48X$, and for 1941, $Y' = .93 + .49X$, Both $R^2 = .99$. Regression lines fitted in a comparable way to data for urban families in 1941, 1944 and 1947 gave the following equations: 1941, $Y' = .64 + .58X$, $R^2 = .99$; 1944, $Y' = 1.47 + .33X$, $R^2 = .95$; 1947, $Y' = 1.61 + .31X$, $R^2 = .96$, based on unpublished data of the Bureau of Human Nutrition and Home Economics. The coefficients of X in these equations are a measure of the income-elasticity of demand for food at a particular period, that is, "static income-elasticity."

For discussion of the technical problems of measurement, see LEWIS, H. GREGG, and DOUGLAS, PAUL H. STUDIES IN CONSUMER EXPENDITURES. The University of Chicago Press, Chicago, Ill. 1947. Also, ALLEN, R. G. D., and BOWLEY, A. L. FAMILY EXPENDITURES, Staples Press Limited. London, 1935.

[5] From table 2, EXPENDITURES AND SAVINGS OF CITY FAMILIES IN 1944, Monthly Labor Review, January 1946.

TABLE 2.—*Estimated retail value of foods consumed per civilian, including expenditures in public eating places, in 1935-39 and current dollars, and ratios to real and current disposable income, 1929-50*

Year	Estimated retail value of food in			
	1935-39 dollars		Current dollars	
	Average per civilian[1]	As a percentage of real disposable income per capita[2]	Average per civilian[3]	As a percentage of current disposable income per capita
	Dollars	*Percent*	*Dollars*	*Percent*
1929	145	26.5	193	28.6
1930	144	28.9	181	30.4
1931	143	30.7	148	29.4
1932	139	35.5	120	31.5
1933	137	35.5	115	32.2
1934	138	32.7	130	32.0
1935	135	29.3	136	30.0
1936	141	27.1	142	27.8
1937	142	26.6	150	27.3
1938	143	26.8	140	27.9
1939	148	27.6	141	26.4
1940	151	26.6	146	25.6
1941	157	24.0	165	24.1
1942	158	21.4	196	22.7
1943	161	20.6	222	23.0
1944	166	19.7	226	21.3
1945	172	20.5	239	22.2
1946	177	22.1	283	25.3
1947	171	23.2	331	28.3
1948	165	22.2	348	27.2
1949	164	22.2	331	26.5
1950[4]	165	21.2	336	25.3

[1] Value aggregates of civilian per capita food consumption index plus estimated extra cost of food in public eating places, in constant 1935-39 dollars.

[2] Department of Commerce series on disposable income deflated by consumers' price index.

[3] Value in 1935-39 dollars multiplied by BLS retail food price index.

[4] Preliminary.

The construction proceeded as follows: The basis for the series was the value aggregates of the civilian per capita food consumption index (quantities of major foods consumed per person multiplied by average retail prices in 1935-39). To these were added estimates of the extra cost for services of public eating places on a per capita basis, estimated from Department of Commerce food-expenditure data, and deflated by the consumers' price index in order to approximate constant prices. The total estimated retail cost of food per person plus additional costs of food served in public eating places was then compared with real disposable income per capita (table 2).

This derived series has the character that would be expected on the basis of Engel's law—we find a higher proportion of income going for food purchases in depression years and a smaller proportion in prosperous years. It represents a static situation in that it does not reflect price changes through time, nor changes in marketing channels. Moreover, because of the rather simple structure of prices used, it does not reflect some of the additional expenditures for commercial processing. On the other hand, some dynamic factors are reflected in the series because they have brought about changes in the rates of food consumption through time. Among these are changes in average incomes and distribution of incomes among consumer units and changes in relative supplies of food and nonfood goods and services. The series explicitly includes the increased expenditures for eating away from home.

Dynamic Situation

The next step toward a dynamic situation is relatively simple. It is the introduction of price changes. The per capita food-value series in constant 1935-39 dollars was multiplied by the retail food price index (1935-39 = 100) and the resulting series was compared with disposable income in current dollars. For prewar years the income-food expenditure relationships changed from year to year in about the way that would be expected from Engel's law. The data for the war years reflect, of course, the controlled prices. For the years after the decontrol of prices in 1946, the introduction of the price factor puts the income-food expenditure relationships out of line with the pattern of the years before 1942. These data present us with the core of our problem, but we defer its analysis until the next section.

At this point, it is necessary to indicate certain deficiencies, from a dynamic standpoint, still inherent in this derived series on retail value of food consumed. They stem from the basic concept of the per capita food consumption index which was constructed to measure quantitative changes in food consumption, rather than qualitative changes or changes in food expenditure.[6] This index includes shifts in consumer purchases from fresh to processed fruits, vegetables, fish and dairy products; but it excludes such shifts within the meat, sugar, and flour categories, as well as the consumption of offals (which is assumed to vary directly

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[6] For description of the index, See UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS, CONSUMPTION OF FOOD IN THE UNITED STATES, 1909-48. U. S. Dept. of Agr. Misc. Pub. 691, June 1949, pp. 88-96.

TABLE 3.—*Department of Commerce estimates of food expenditures, including alcoholic beverages, and adjusted estimates of food expenditures, per person and as a percentage of disposable income, 1929-50*[1]

Year	Food and alcoholic beverage expenditures		Expenditures for food including rough adjustments to exclude military food and value all food except that in public eating places at retail	
	Per person in current dollars	As percentage of disposable income	Per person in current dollars	As percentage of disposable income
	Dollars	*Percent*	*Dollars*	*Percent*
1929	160	23.8	179	26.6
1930	146	24.5	164	27.6
1931	118	23.4	136	26.9
1932	91	23.9	107	28.0
1933	91	25.4	102	28.5
1934	112	27.6	112	27.6
1935	127	28.0	123	27.1
1936	143	27.9	134	26.1
1937	154	28.1	142	25.9
1938	145	28.9	135	26.9
1939	146	27.4	134	25.2
1940	156	27.4	141	24.8
1941	182	26.5	163	23.8
1942	228	26.4	201	23.3
1943	257	26.6	232	24.0
1944	280	26.5	247	23.3
1945	306	28.4	268	24.9
1946	354	31.7	310	27.7
1947	391	33.4	349	29.9
1948	406	31.8	371	29.0
1949	390	31.2	356	28.5
1950[2]	396	29.8	362	27.2

[1] See text for description of adjustments.
[2] Rough estimates only.

with consumption of carcass meat, but contributes an increase of $3). The inclusion of these factors would add about $5 to the average retail value of food consumed in 1939 and $15 in 1947 (in current dollars).

The effect of two other factors in food expenditures, which were important only in the war period of the two decades covered by the data, is also omitted by this series. The factors are the understatement of prices by the retail-price series during the war (because of such developments as disappearance of low-cost items and deterioration of quality) and shifts from lower cost to higher cost marketing channels — for example, from chain stores to small independent stores. The shifts are discussed later.

We are now ready to analyze two well-known series relating to food expenditures—the Department of Commerce series on food expenditures and the Department of Agriculture series on the retail cost of farm food products. Although both of these are affected by dynamic factors, certain adjustments are necessary to bring them in line with the concepts of retail value of the survey data on food expenditures. The Commerce series is compiled as part of the process of estimating national income.[7] It should be noted that these data include food and beverages purchased for off-premise consumption (valued at retail prices), purchased meals and beverages (including service, etc., valued at prices paid in public eating places), food furnished to commercial and Government employees including military (valued at wholesale), and food consumed on farms where grown (valued at farm prices).

The following very rough adjustments were made in the Commerce series: (1) A rough division of expenditures for alcoholic beverages was made into purchases for off-premise consumption and purchases with meals; the former was then subtracted from the combined total of off-premise food and alcoholic beverages expenditures. (2) Food furnished civilian employees was revalued at approximately the retail level as was food consumed on farms where produced. (3) The revised estimate of total retail value of civilian food (in current dollars) was put on a per capita basis and compared with disposable income per capita. This series (table 3) bears out Engel's law until about 1945. From then on, the proportions of disposable income spent for food are even more out of line with prewar years than are those in the new series described above.

The other existing series, the retail cost of farm food products,[8] excludes food consumed on farms where produced, imported foods, non-civilian takings, nonfarm commodities, and alcoholic beverages. To obtain comparability, estimates of the retail value of farm-produced and farm-home-consumed foods, of the nonfood costs in public eating places, of the retail value of imported foods, and of fish and fishery products, were added to the retail cost of farm food products. Table 4 contains the adjusted series and comparisons with disposable income.

Comparison of the three series indicates that the general patterns are rather similar although the levels are somewhat different. The series derived from the value aggregates of per capita consumption is generally lower than the adjusted series

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[7] For a brief summary of the methods used in constructing this series, see *ibid.*, pp. 96-98.

[8] *Ibid.*, pp. 98-100, and The Marketing and Transportation Situation, September 1950, pp. 11-15.

TABLE 4.—*Retail cost of farm food plus adjustments to cover all foods and extra services of public eating places, total and per capita compared with disposable income, 1929-50*

Year	Retail cost of farm food[1]	Adjusted retail cost of all foods for civilians[2]		Adjusted retail cost per capita as percentage of disposable income
		Total	Per capita	
	Million dollars	*Million dollars*	*Dollars*	*Percent*
1929	17,920	24,900	203	30.2
1930	16,810	23,420	189	31.8
1931	13,600	19,200	154	30.5
1932	11,070	15,770	126	33.0
1933	11,340	15,770	125	34.9
1934	12,870	17,570	138	34.1
1935	13,470	18,780	147	32.4
1936	14,720	20,200	157	30.5
1937	14,690	20,390	157	28.7
1938	13,960	19,340	148	29.5
1939	14,100	19,340	147	27.5
1940	14,630	19,870	150	26.2
1941	16,530	22,410	169	24.6
1942	19,900	26,430	200	23.2
1943	22,110	29,960	231	24.0
1944	22,060	30,250	234	22.1
1945	23,630	32,330	249	23.1
1946	30,450	40,610	292	26.1
1947	35,950	47,830	333	28.5
1948	37,970	50,310	344	26.9
1949	36,200	47,690	321	25.7
1950[3]	36,800	48,500	321	24.3

[1] From table 5, p. 12, *Marketing and Transportation Situation*, September 1950.

[2] Adjusted as described in text.

[3] Rough estimates only.

based on retail cost of farm food products. On the other hand, the series derived from the Department of Commerce food-expenditure data is significantly lower in prewar years and higher since 1943 than the data in the other two series.

Study of the proportion of average disposable income spent for food in relation to the level of real income in the years 1929-41, as measured by each of the series (fig. 2), leads to the surmise that national averages of income-food expenditure relationships through time do tend to follow Engel's law.[9] The complexity of wartime price and supply relationships prevents our drawing any conclusion from the lower percentages spent for food during the years 1942-45, when real income per capita was the highest on record. The ratios of average food expenditures to average disposable income since 1945 bring us to our real problem.

Postwar Income-Food Expenditure Relationships

A higher ratio of food expenditures to disposable income, in terms of national averages, can result from (1) lower average real incomes, which would be accompanied by a change in the proportional distribution of the population among and/or within the several real-income groups; (2) an increase in average food expenditures, with or without a change in the "static income-elasticity of demand." An example of this would be a rise in the average food expenditures of two or three adjacent income groups with none in the others and no change in average incomes of each group. If there is an equi-proportional rise in food expenditures of all income groups, there will be no change in static income-elasticity of demand but a higher "dynamic income-elasticity of demand" would result. This term is used here to describe the relationship of changes through time in the national average of food expenditures to changes in national average income.[10]

The situation in 1946-49 did not result from the first of these alternatives because real incomes per person (disposable) were substantially higher than before the war, although they were somewhat less than in 1945.

The fact that food expenditures have increased more than incomes since 1940 and 1941, so that the ratio between the two has risen, indicates an increase in the demand for food. Is this increase likely to be permanent or have unusual factors of short duration brought about only temporary aberrations in the underlying pattern of income-food expenditure relationships? Obtaining an answer to this question necessitates the determination of the

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[9] The following regression equations were calculated from the logarithms of the income-food expenditure ratios (Y) and of the index of real disposable income per capita (X) (1935-39 = 100), fitted 1929-41;

(a) Series derived from per capita consumption and retail food price indexes

$Y' = 2.54 - .55X;\ R^2 = .86$

(b) Adjusted Commerce food expenditure series

$Y' = 2.04 - .31X;\ R^2 = .83$

(c) Series based on retail cost of farm food products

$Y' = 2.71 - .62X;\ R^2 = .83$

[10] The regression equations for the logarithms of the four food expenditures series (Y) and the logarithms of disposable income per capita (X), 1929-41 are:

(a) Series derived from per capita consumption data, in constant dollars (against real disposable income)

$Y' = 1.53 + .23X,\ R^2 = .73$

(b) Series derived from per capita consumption and retail food price indexes (current dollars)

$Y' = .35 + .67X;\ R^2 = .84$

(c) Adjusted Commerce food expenditure series (current dollars)

$Y' = -.07 + .81X;\ R^2 = .96$

(d) Series based on retail cost of farm food products (current dollars)

$Y' = .53 + .61X;\ R^2 = .78$

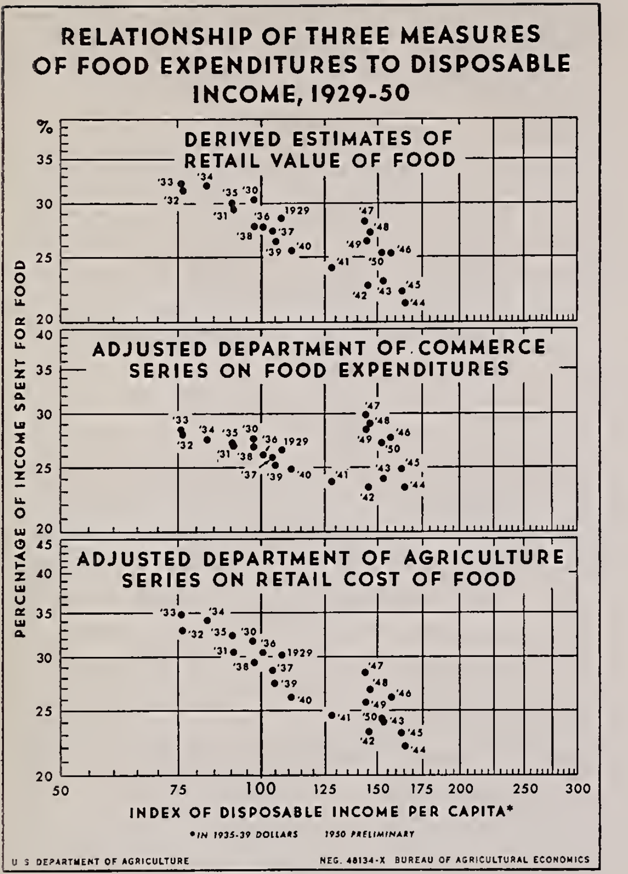

FIGURE 2

major factors in higher food expenditures and insofar as possible the evaluation of their importance. A supplemental problem is the determination of whether the change in demand for food has taken place equally at all income levels or only in some segments; that is, whether the "static income-elasticity of demand for food" has changed.

The first step in the analysis of postwar income-food expenditure relationships is to measure so far as possible the effect of changes in the average level of income and the distribution of income within the population on the national average of the relationship of food expenditures to income. The sum of the population in each income group multiplied by the average income of that group divided by the total population, will give a reasonable approximation of average income. A similar procedure will give average food expenditures. In order to evaluate the effect of changing income on income-food expenditure relationships, it is advantageous to hold prices constant. Distributions of individuals by total disposable real income per consumer unit have been developed for several years (adjusted to consumers' price index of 133), although they should be regarded only as rough approximations. These were used to derive weighted averages of income and food expenditures (including alcoholic beverages) for those years. The weighted averages of income in 1943 and 1946 underestimate the average income in those years by 5 to 10 percent, according to comparable estimates of non-military, non-institutional income derived from data of the Department of Commerce. This is largely the result of some upward shift within income groups, particularly that with real incomes above $5,000. However, an accompanying upward movement in the averages of food expenditures for each group would be expected.

In table 5 the derived estimates of income and food expenditures, adjusted to exclude the costs of alcoholic beverages, are compared. The results indicate that food expenditures would have been expected to take 31 percent of total disposable income in 1935-36 and 24 percent in 1948 if people at each level of real income in those years spent the same proportion of income for food as did people at that income level in 1941. In other words, all factors except income are held constant and there is no change in static income-elasticity of demand for food. Under these conditions, the national averages of the relationship of food expenditures to income would follow Engel's law. With about the same real disposable income in 1949 as in 1948 we might expect the same proportion of income to have been spent for food.

At this point, we recall that the static pattern of income-food expenditure relationships did change for urban families between 1941 and 1947, as shown by figure 1. This change indicates the importance of factors other than shifts in the distribution of income and higher average income to the level of postwar food expenditures. These factors may be short or long in duration.

Two obviously short-run factors were (1) the natural lag in adjustment of food-consumption patterns to rapid postwar changes in income and in the relative supplies of food and nonfood commodities and (2) availability of unusual sources of purchasing power over and above current income.

Record quantities of food had been consumed at controlled prices during the war, with the peak coming in 1946 when very large supplies were available for civilians, prices were still controlled

TABLE 5.—*Rough approximations of distribution of individuals by consumer-unit disposable incomes in selected years; 1941 survey pattern of per capita incomes and food expenditures adjusted to consumers' price index of 133; weighted averages of disposable incomes and food expenditures in selected years, and ratios between them*

Total disposable income per consumer unit[1]	Approximate proportion of individuals[2]					Estimated average per capita, 1941 survey pattern adjusted to CPI of 133[3]		
	1935-36	1941	1943	1946	1948	Disposable income	Food expenditures	Percentage of income
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Dollars*	*Dollars*	*Percent*
Under $500	11	3	3	3	3	122	100	82
500 to 999	17	10	7	6	6	293	150	51
1,000 to 1,499	20	10	10	8	9	446	189	42
1,500 to 1,999	16	13	14	11	10	529	194	37
2,000 to 2,999	19	24	23	22	27	734	241	33
3,000 to 4,999	12	27	27	32	28	1,008	284	28
5,000 and over	5	13	16	18	17	2,027	406	20

Item	Weighted average at consumers' price index of 133				
	1935-36	1941	1943	1946	1948
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Average real disposable income per capita[4]	599	858	908	964	939
Average expenditure for food and alcoholic beverages	206	249	257	265	262
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
Percentage of income					
Total	34	29	28	27	28
Alcoholic beverages[5]	3	4	4	5	4
Food	31	25	24	22	24

[1] Money and nonmoney income; dollar values set 33 percent above 1935-39 average.

[2] Estimated by author with assistance of Nathan Koffsky, Selma Goldsmith, and Richard Butler, using data from *Study of Consumer Incomes for 1935-36, Study of Family Spending and Saving* data and Office of Price Administration estimates for 1941 and 1943, and data of the Census Bureau and the Council of Economic Advisers for 1946 and 1948. All distributions in terms of dollars at consumers' price index of 133 percent of 1935-39 average.

[3] The 1941 survey pattern of average incomes and food expenditures given in table 1 was adjusted from the price level 5 percent above the 1935-39 average, to a price level 33 percent above that average, in order to be on same dollar-value basis as the income distributions and to match data previously developed on per capita food consumption by income level.

[4] Derived from adjusted 1941 survey pattern. Averages for 1943 and 1946 appear to be 5 to 10 percent low, in comparison with averages derived from aggregate national income data, because of somewhat higher average incomes within income groups, particularly the much higher average for the group with incomes over $5,000. This understatement of income would be accompanied by some understatement of food expenditures; therefore, the derived proportion of income spent for food is regarded as a reasonable estimate, under the conditions imposed.

[5] Estimated from 1941 survey data.

for part of the year, and demand for food was exceedingly strong. Civilian per capita food consumption in that year averaged 19 percent above the prewar average. Not all of this food was eaten in the calendar year 1946. Some went to restock pantry shelves as well as those distribution channels for which no inventory data are available.

Then in 1947 apparent consumption of food per person declined to an index of 115, but retail food prices averaged 21 percent higher than in 1946. A possible explanation of the precipitous rise in food prices after decontrol in 1946, as well as their high levels in 1947 and 1948, is the fact that many consumers, particularly those of low and medium incomes, were willing to spend increasingly more money if necessary in order to continue to buy the quantity, the quality, and the kinds of foods they had become accustomed to buying in the preceding years of high incomes and controlled prices, or that they had wanted and couldn't buy because of restricted supplies and official and unofficial rationing during the war. After the middle of 1948 there was a gradual change in per capita rates of civilian consumption of most individual foods toward those of the prewar high-income years, and the proportion of disposable income spent for food also declined significantly.

Contributing to the lag in adjustment of food-consumption patterns and food prices was the availability to many families of unusually large liquid assets, the relaxation of controls on consumer credit, the opportunity to reduce the rate of savings, as was done, and the continued shortage of some durable items of high cost, such as cars and houses. The use of liquid assets and consumer credit to buy consumers' goods and services represented, in the first instance, a net addition to the purchasing power available from current income. Later, this purchasing power was incorporated, at least in part, in the flow of the income stream and included in disposable income of other individuals, corporations, and Government. Accordingly, for a year such as 1947, the average disposable income understates the purchasing power of consumers and leads to a disproportionately high estimate of the ratio of food expenditures to purchasing power.

The use of liquid assets and the opportunity to increase consumer debt were particularly significant for low- and moderate-income families, in 1947-49. With such supplemental purchasing power many were able to keep up their high wartime rate of expenditure for food and other nondurable goods even while they increased their purchases of durable goods. Data from the 1950 Survey of Consumer Finances indicate that among those spending units that were reducing liquid assets in 1949, 49 percent of the units with incomes under $2,000 reported using at least part of their liquid assets for food, clothing, and nondurable goods, compared with 31 percent for the $2,000 to $4,999 income group and 17 percent of those units with incomes over $5,000.[11] The extra purchasing power available for food apparently contributed substantially to the higher level of food expenditures in relation to income, in 1947 compared with 1941, and to the reduction in the ''static income-elasticity of demand'' indicated in figure 1.

Surveys of consumer finances made for the Federal Reserve Board indicate that record amounts of liquid assets, which had been accumulated during the war and immediately thereafter, were reduced significantly from 1947 to 1950—from $470 per spending unit early in 1947, to $350 a year later, $300 early in 1949, and $250 in 1950. The reduction was about $39 per person in 1947 and $16 in both 1948 and 1949, and represented an addition of that amount to the purchasing power available from current income. According to the 1949 survey[12] about one-third of the reduction in 1947 went directly into nondurable goods and services and one-fifth for automobiles and other durable goods.

Another important source of funds for consumers' expenditures in 1947-49 was the rapid expansion in consumer credit as controls over consumer credit were relaxed after the war. Outstanding consumer indebtedness increased $3.2 billion in 1947, $2.5 in 1948, and $2.4 in 1949. The increase of $3.2 billion in 1947 amounted to $22 per capita.

The total of the reduction in liquid assets and use of consumer credit in 1947 amounted to about $61 per person, in 1949 to $32. The addition of this extra purchasing power to current disposable income brings total purchasing power per capita for 1947 up to $1,231, and to $1,281 in 1949. This makes a significant change in the ratio of food expenditures to purchasing power, from the 29.9 percent, based on adjusted Commerce data, to 28.4 percent in 1947, and 28.5 to 27.8 percent in 1949.

Expenditure and savings data of the Department of Commerce indicate the unusual character of the income-expenditure-savings relationships in the immediate postwar years.[13] Although disposable personal income rose $10.6 billion from 1946 to 1947, the rate of savings declined $8 billion. Expenditures for personal consumption increased $18.7 billion. The increase of $4.8 billion in expenditures for durable goods was to be expected on the basis of deferred demand for such items, but the $9.3 billion increase in nondurables greatly exceeded expectations. Much of this increase was in food expenditures, as already noted. The fact that the decline in the proportion of income going to food in 1948, 1949, and 1950, was not offset by increases in expenditures for other items, but was offset in part by a return to the prewar relationship of savings to high-level disposable incomes, gives further support to the hypothesis that the extraordinarily high expenditures for food in 1947 and early 1948 were due largely to a temporary lag in the adjustment of patterns of consumer-expenditure and savings to a changing situation.

We now consider possible factors contributing to the postwar rate of food expenditures which are likely to be more permanent in duration and most of which appear to indicate some changes in manner of living. Among such factors are movement of population from rural to urban areas, increased ''eating out,'' shifts in channels of distribution, increased consumption of processed foods, greater use of fresh vegetables in ''off-seasons,'' and changes in the age distribution of the population.

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[11] Table 14, Part V, reprinted from Federal Reserve Bulletin for December 1950.

[12] Page 8, part III, of the reprint from the Federal Reserve Bulletin for July 1949.

[13] Excellent discussions of these relationships may be found in two articles in the *Survey of Current Business*, FRIEND, IRWIN, PERSONAL SAVINGS IN THE POSTWAR PERIOD, September 1949; ATKINSON, L. JAY, THE DEMAND FOR CONSUMERS' DURABLE GOODS, June 1950.

A movement of population from rural to urban areas, such as that which took place between 1941 and 1949, is bound to affect food expenditures and incomes, but the extent is difficult to measure. Obviously, farm families spend less money for food than nonfarm families because they grow some of their own food and the food they buy costs about 10 percent less than the urban prices.[14] But nonfarm incomes average much higher than farm incomes, even on the basis of total disposable income. The problems of definition of net farm income and valuation of home-produced foods make the comparison of urban and rural patterns of income-food expenditure relationships subject to considerable question.[15] However, the proportion of income spent for food was calculated for 1949 using both the January 1, 1941 ratio of farm to total population and the January 1, 1949 ratio, along with the 1941 survey data on farm and nonfarm average money and nonmoney food expenditures and disposable income. (These data had not been inflated to national totals shown by Department of Commerce data.) Use of the 1941 ratio resulted in food expenditures averaging 28.7 percent of reported disposable income whereas the 1949 ratio resulted in 28.3 percent.

This shift from rural to urban areas is not reflected fully in the three adjusted series on food expenditures. The series which was derived from the per capita food-consumption aggregates values all foods at prices paid by moderate-income families in urban areas. The other two series, as adjusted to the concepts of the survey data, value the food for home consumption on farms where produced at a composite rural-urban price.[16] At the most, the difference in prices paid for food arising from the rural-urban shift might account for a $7-increase in the national average of food expenditures, equivalent to about 0.6 of a percentage point in the ratio of food expenditures to income in 1949. The effect on food expenditures of changes in the distribution of the population by income group reflects most of the impact of the rural-urban shift.

One factor in higher postwar food expenditures—increased eating in public restaurants and other institutions—appears to be a significant change in eating habits. The costs of ''eating out'' include the payment for additional processing, serving, atmosphere, and sometimes entertainment. If a greater proportion of total food consumed is purchased in public eating places, expenditures for food can be higher even without a change in total quantities of food consumed. The increased cost due to this factor was about $8 per person, from 1941 to 1949, equivalent to 0.6 percent of disposable income in the latter year.

Another type of shift in the channels of food distribution which would be expected to affect the level of food expenditures is the shift from lower cost to higher cost distributors in urban areas, such as that from large chain stores to small corner groceries or delicatessens. This factor was probably important during the war but the 1941 pattern of distribution was apparently restored by 1949. For example, chain-store and mail-order food sales accounted for 29.8 percent of total retail sales in 1941, 25.4 percent in 1944, 29.9 percent in 1948, and 31.7 percent in 1949.

In the discussion of the retail-value or food-expenditures series derived from the per capita consumption and retail food price indexes, mention was made of the additional cost of processed food in postwar years compared with a prewar year. The increase between 1939 and 1947 which had not been accounted for in the derived series is estimated at about $7 per capita (excluding the increase in cost of offals). Analysis of the shifts from fresh to processed foods reflected in the consumption index for 1941 and for 1949 is the basis for an estimate of $5 for the remaining part of the additional cost (in 1949 prices). The pattern of fresh versus processed foods in 1939 was probably not greatly different from that of the 1941 survey of family food consumption, nor was 1947 much different from 1949 for the foods in the omitted category.

Accordingly, we may conclude that the total increase in food expenditures from 1941 to 1949, due to shifts to foods processed outside the home (except in public eating places) might amount to $12 per person, or 1 percent of disposable income. But at this point we recall that some of the shift from fresh to processed foods would be expected to result from increased incomes. An item-by-item analysis of income-expenditure patterns is the basis for the estimate that about three-fifths of this rise in food expenditures for processed foods is due to higher incomes, and two-fifths is due to the trend toward increased processing outside the home, which is a continuing change in food marketing.

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[14] See p. 161 of the article by NATHAN KOFFSKY, FARM AND URBAN PURCHASING POWER in volume II of Studies on Income and Wealth.

[15] Margaret G. Reid, in intensive research in this area, has found evidence of similarity between the rural and urban patterns when major farm expenses are spread over several years and apparent variations in incomes are averaged out.

[16] Combining the prices paid by farmers, BAE index, for rural segment of the population and the BLS retail food prices for the urban population.

In order to learn the possible effect on food expenditures of somewhat greater consumption of foods in ''off-seasons'' (from local production), available data on changes in seasonal production of several foods were studied. The only item showing a significant change was truck crops for fresh market. Even here, the increase in output in the winter season, from 1941 to 1949, totaled less than 10 pounds per capita and the increased cost totaled only about 15 cents.

The substantial increase in the birth rate during the last 11 years leads one to consider the effect of a larger proportion of children on food expenditures. The increased consumption of prepared baby foods and of dairy products has already been accounted for. As to other commodities, it might well be argued that this change in age makeup might contribute to lower rather than to higher food expenditures.

To summarize, on the basis of changes in average income and distribution of income we would have expected 24 percent of disposable income in 1949 to have been spent for food, instead of the 28.5 percent indicated by the adjusted Commerce Department food expenditure data, 25.7 percent indicated by the adjusted series on retail cost of farm food products, and 27.7 percent by the derived series (including additional processing and offals). If we add to the 24 percent figure the effects of the enduring, dynamic factors, roughly 0.6 percent for the rural-urban shift (not already accounted for by income changes), 0.6 percent for increased costs of eating out, and 0.4 percent for the extra costs of processing in 1949 as compared with 1941 and not due to higher incomes, we obtain 26 percent as the estimated relationship of food expenditures to disposable income. Furthermore, we should take into consideration the additional $33 of purchasing power (1949 dollars) available per person in 1949 from the use of liquid assets and consumer credit. This would increase the derived ratio of food expenditures to available purchasing power by another 0.7 percent and bring it surprisingly close to the ratios derived from the three dynamic series. The proportion of current income spent for food in 1950 was again lower than in the preceding year, indicating further adjustment in the income-food expenditure relationship toward the long-time pattern. Moreover, the outbreak of hostilities in Korea undoubtedly encouraged extra buying to increase the stocks of food in households.

Conclusions

We may draw three conclusions from the foregoing analysis.

(1) Engel's law probably applies reasonably well to the relationship of national averages of income and food expenditures through periods in which no substantial changes take place in population patterns, distribution of income, manner of living, and marketing practices. That is to say, it applies under conditions that are relatively static and are similar to the circumstances in which Engel formulated his law.

(2) In the wartime and immediate postwar years certain forces arising from the war materially altered the peacetime pattern of national averages of income and food expenditures. Some of these carried over as far as 1949, although they were essentially temporary in character. The most significant were the supplemental sources of total purchasing power and the diversion of an unusually large proportion of that purchasing power to food, as long as supplies of durable goods, particularly the expensive items, failed to meet the potential demand. These forces increased the dynamic elasticity of demand by raising the level of food expenditures and decreased the static income elasticity of demand by raising the food expenditures of lower- and moderate-income families more than those of families of higher income.

(3) Two dynamic forces active in 1941-50 are likely to have a lasting effect on the relationship of aggregate food expenditure to income: the shift of population from rural to urban areas and the change in manner of living reflected in increased processing of food outside the home, either in public eating places or in processing plants. These forces appear to have increased the dynamic income elasticity of demand for food by raising the general level of food expenditures. Lacking sufficient basis as yet for ascertaining the contribution of these enduring forces to the lower static income elasticity of demand that is evident in the 1947 urban data compared with 1941, we cannot estimate their possible offsetting effect upon future dynamic income elasticity of demand for food.

Changes in Production During World War II, By Size of Farm

By Jackson V. McElveen[1]

American agriculture is again being asked to expand output to meet national emergency needs. BAE, in cooperation with the Land-Grant Colleges and other agencies, is undertaking a survey of the potentialities for increasing farm output in 1952 and later years. This paper compares the performance of different sizes of farms during World War II in the spectacular increase of output then achieved, and points the moral in relation to our present production program.

PRESENT NEEDS for increasing agricultural production direct attention to the production capacities of farm families as an integral part of the national economy. Increases in agricultural production must be attained as efficiently as possible and must be accomplished with a minimum drain on scarce items. A decision as to where and how such production can best be achieved depends partly upon what farms can increase their production the most with their currently available labor and materials. Equally important is the problem of channelling the right type of assistance to the right kind of farms. In this setting the relative contribution of different sizes of farms is a question of considerable significance.

The purpose of this article is to investigate changes made during World War II when farm production was expanding rapidly. The findings should be helpful when the future possibilities among sizes of farms are evaluated. It may cast some light on the question, "Where can production be increased most readily?"

In the last war agriculture responded to the emergency by a tremendous increase in production. The total volume was increased by approximately one-fifth. It was done in the face of war-imposed scarcities of labor and of many types of farm equipment and supplies.

In the immediate future there seems to be little prospect of increasing materially the present 1,140 million acres of land now in farms. As much of this land is not at present adaptable to a more intensive land use, the cropland harvested is not expected to increase much above the 1945 figure of 353 million acres. Nor is there so much opportunity as formerly of shifting acres from production of horse-and-mule feed to production for human consumption, now that horses and mules have declined to about 6 million compared with 13 million in 1940. The bulk of any production increase must come from increased efficiency and the application of improved technology to existing land resources.

Our agriculture is characterized by family-operated farms. Management, capital, and most of the labor is provided by the farm family. As farms increase in size the production becomes more mechanized. Further increases in size are characterized by the greater relative importance of hired labor. The predominance of family-farms is indicated by the fact that of the 10 million agricultural workers employed in 1950, more than 75 percent were classified as operators and members of operator families.

This study tries to measure the changes in production per unit of land resources that took place on family farms, compared with large farms, during the war period 1939 to 1944. No one measure of size makes this separation adequately. The problem of separation is further intensified when the type of farm and the geographic location are considered. Therefore the terms "large" and "family size," as used in this study, indicate a relative rather than absolute division of commercial farms.

Procedure

Data used in this study were taken from the United States Census of Agriculture Special Reports on Farm Characteristics by Value of Products, 1940 and 1945, and Economic Classes of Farms, 1945. These reports are based on a sample of farms included in the Census of Agriculture.

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[1] Kenneth L. Bachman assisted in the development of the principles used in this study. Discussions with Richard O. Been and Glenn L. Burroughs were helpful in the development of the statistical method.

The sampling rate varied from a 2-percent sample in 1940 to approximately a 7-percent sample in 1945.

Estimates of production per acre and of production per acre equivalent of land were derived for each of the value-of-product groups of commercial farms.[2] Production per acre equivalent was used as a primary measure because it reflects the effect of the addition of less productive land during the period 1939-44. Production per acre equivalent and production per acre were plotted by value of products adjusted for price levels by deflating for prices received by farmers.[3] A correction factor was used to adjust for shifts in the farms in each value group arising because of changes in output per acre.[4]

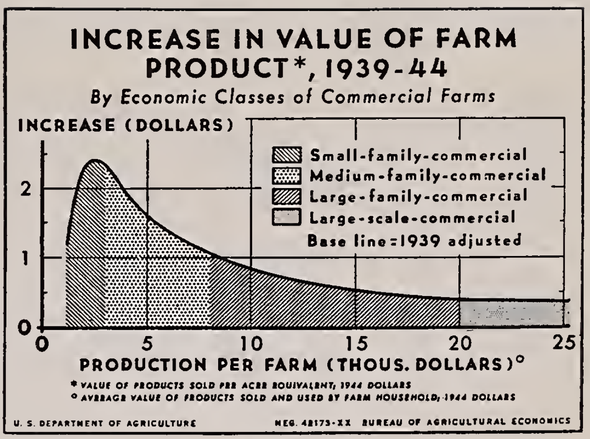

FIGURE 1

There were also shifts of farms between value groups caused by the trend toward larger farms. Combinations of farms that took place, particularly among the smaller sizes, meant that a considerable number of farms moved into higher value-of-product groups. The effect of this on the over-all measure of production per acre equivalent would be problematical. It would depend on what kinds of farms combined and what associated changes occurred in the farm organization.

In the final analysis, farms with a value of products of under $1,200 were excluded. Many farms that had a value of products of less than $1,200 were part-time and nominal units; their changes were not considered to be significant. Excluded were approximately one-half million part-time, 1 million nominal, and 1 million small-scale farms.

Changes in Production Intensity

Measured by production per acre equivalent of land in farms, the increase in production from 1939 to 1944 was greatest on small-to-medium commercial family farms (fig. 1). The increase in production per acre equivalent between 1939 and 1944 reached a maximum for farms with about $1,500 to $4,000 gross value of products and gradually declined among larger and smaller farms. Farms included in the study were divided into four

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[2] In order to obtain comparability among groups of farms between 1939 and 1944, acres in each group were converted to acre equivalents. Had these adjustments not been made the 1944 value groups would have been subjected to a downward bias in comparisons of production per acre because of the 8-percent increase in land in farms. Most of this land came in the mountain region. Because of the lower production per acre and the predominance of larger farms there, this bias would have been particularly evidenced among the larger sizes of farms. An acre equivalent is the amount of land that equals in value the average value of land per acre in 1940. With the application of this the new land brought into agricultural use during 1939-44 was weighted equivalent to its relative value.

[3] A possible cause of bias would occur if size groups of farms produced in different proportions, products whose prices rose (or fell) more than the average of all prices received. However, no substantial difference was observed in the price behavior of outputs on different sizes of commercial farms except in the case of large-scale farms. Prices received for products sold from these farms in 1944 increased slightly more than the U. S. average.

[4] For purposes of comparison farms are grouped for size by value-of-product intervals. The amount of production increase or decrease that any individual farm may show and still remain within the value-of-product interval depends upon the width of the interval and the farms' position within the interval in respect to the upper and lower limits. Farms that are just below the upper limit of the value-of-product interval will move into the value group above, with any increase in production. Therefore, any increase in production for a value group is accompanied by a loss of farms to the value group above and a gain in farms from the value group below. As large farms have a higher production per acre equivalent than smaller farms, the effect of such a movement would be to minimize the production increase that could be indicated for any value group. The relative extent of this minimization was determined by the relationship in 1939 of the production per acre equivalent and number of farms per unit of value interval at the upper limit of each value interval compared with the production per acre equivalent and number of farms per unit of value interval at the lower limit of each value interval. The correction factor used was the relationship between an assumed percentage increase and the resultant indicated increase, or X : Y when:

$$Y = \frac{\Sigma (P+PX) N + \Sigma (P_1+P_1X) N_1 - \Sigma (P_2+P_2X) N_2}{N + N_1 - N_2}$$

X = Percentage increase in product per acre equivalent

P and N = Product per acre equivalent and number, respectively, of farms in the value group in 1939

P_1 and N_1 = Product per acre equivalent and number, respectively, of farms that could be expected to move into the value group from the value group below as a result of X percent increase in product per acre equivalent

P_2 and N_2 = Product per acre equivalent and number, respectively, of farms that could be expected to move into the value group above as a result of X percent increase in product per acre equivalent.

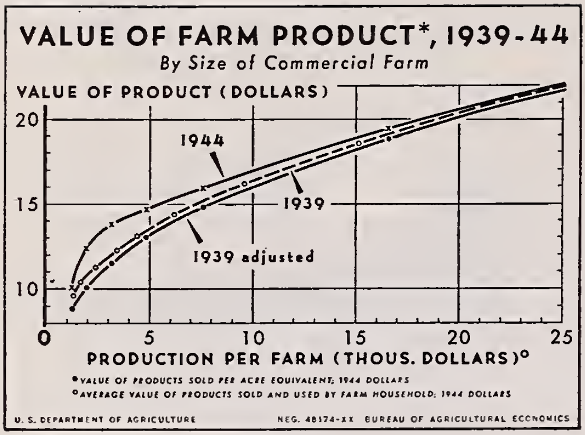

Figure 2

groups for purposes of comparison with the existing economic classification. In 1945 there were approximately 1½ million farms classified as small commercial-family farms, 1 million medium commercial-family farms, ½ million large commercial-family farms, and 100,000 large-scale farms.[5]

The product per acre equivalent on large farms was greater than on smaller farms in both 1939 and 1944 (fig. 2). However, farms from $1,500 to $4,000 tended to increase production at a greater rate from 1939 to 1944. This increase brought the levels of production per acre equivalent closer together.

Measured by production per acre, the farms above the $5,000 value-of-product group showed a decrease in production in 1945 whereas commercial farms below the $5,000 value group increased production per acre. The actual decrease on larger farms is due largely to the increase in acres of land in farms during the war. The use of acre equivalents of land as a measure is an attempt to correct for this bias.

In an effort to test these relationships in a specific area, a study was made of Illinois farm-account farms in farming-type areas 2, 3, 4, and 5. The farms were grouped for size by acres of land in farms and compared over the period 1940-43 (table 1.). (Comparable data for these areas were not available for 1939-44.) The same general relationship between size groups is apparent. Average gross earnings per farm and average gross earnings per acre increased more on the smaller farms. This increase in product per acre was 9 percent in the group of less than 120 acres and declined to only 1 percent on farms of more than 280 acres. These data are restricted to a certain kind of farm in a certain kind of area in one State. The range in size approximates that of medium and large commercial farms in 1945, but the data fit into the pattern for the United States and to some extent substantiate the trend shown in figure 1.

The increase in production from 1939 to 1944 was largely due to increases in production per acre equivalent of land. Most of this increase came from medium and small commercial-family farms. An explanation involves an analysis of the situation during the period 1939-44 with respect to labor, mechanization, and levels of technology employed on different sizes of commercial farms. Another factor to be considered is the long-time trend toward larger and fewer commercial farms.

Larger farms were much more dependent upon hired labor. Possibly in many cases labor shortage could be met only by a more extensive land use. This was the most profitable alternative of farms that had already taken fullest advantage of mechanization and other labor-saving innovations.

Family farms, dependent primarily upon family labor, tended to have a more plentiful labor supply. Participation of the old and young and of women, when work was heaviest, lent a degree of flexibility in the number of hours worked. Family farms were also much less mechanized. With this greater latitude, they responded with a tremendous substitution of machinery for hand labor; tractors for workstock. This transfer of acres from the production of feed for workstock to the production for human consumption played an influential part in the increased volume of agricultural products for sale in 1944. Medium and small commercial family farms that reported tractors increased by more than 50 percent, an increase of 400,000 farms. Large-scale and large commercial family farms reporting tractors increased by 100,000 farms during the period. This does not take into account the numbers of tractors. It is probable that on many farms that had one tractor in 1940, another was added during this period. Sizes of tractors or the workstock displacement per tractor, or both, may have been greater on large farms. Nevertheless, it is apparent that the number of acres released for production for human consumption was much larger on medium and

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[5] See Bachman, K. L., and Jones, R. W. SIZES OF FARMS IN THE UNITED STATES. U. S. Dept. Agr. Tech Bul. 1019. July 1950.

TABLE 1.—*Size of farm related to farm earnings and other factors for farm accounting farms in farming type areas 2 3, 4, and 5, Illinois, 1940-1943, Illinois Farm Economics*

(Deflated 1943 = 100)

Item	Under 120 acres		121–200 acres		201–280 acres		Over 280 acres	
	1940	1943	1940	1943	1940	1943	1940	1943
Number of farms	212	144	662	503	456	386	560	342
Acres per farm	103	106	167	167	242	241	403	410
Average gross earnings per farm[1]	$4,829	$5,408	$7,535	$7,907	$10,320	$10,611	$16,073	$16,104
Percent increase	xxx	12	xxx	5	xxx	3	xxx	0.2
Average gross earnings per acre[1]	$47.11	$51.30	$45.03	$47.34	$42.56	$44.04	$40.12	$40.65
Percent increase	xxx	9	xxx	5	xxx	3	xxx	1

[1] Includes the value of farm products used in the household; also includes any increase or decrease in inventory from the preceding year.

small commercial family farms during the war.

It is also reasonable to assume that family farms lagged somewhat behind large farms in the extent to which they had adopted such technological advancements as improved varieties of seed, improved insecticides, and proper use of fertilizer. The increase in the volume of agricultural production was not due merely to additional inputs. Rising farm prices hastened technological change. The production response to price changes that took place on the efficient farm, operating at or near its highest profit combination, was likely to have been very small when reckoned as a percentage change in total product. Farms operating at lower levels of efficiency tended to change the quality of inputs and not so much the quantity. Use of better cultural methods and the more efficient allocation of inputs contributed most in raising the levels of production.

Another factor is the trend in size and number of farms during the war. The number of farms over 500 acres increased more during the war years than in any 5-year period except 1925-30. Contributing to this increase was the stimulant of rising costs of labor in relation to costs of land. To the extent that additional inputs of land were more profitable than additional inputs of labor, a more extensive land use was a combination of higher profit.

An enormous shift took place from small to larger family farms. Apparently this was accomplished with little loss in intensity. The shift was to a size of operation that would more adequately utilize the advantages of mechanization and provide fuller employment for the farm family.

Regional estimates raise difficult problems of deflation for changes in prices, sampling reliability, and variations in crop yields from region to region. Tentative evidence indicates a general similarity of trends in most regions. In the middle Atlantic region and in the Pacific region, however, trends were somewhat different. This may be partly due to variability in type of farming and variations in prices received for different agricultural commodities in 1944 relative to 1939.

Application to the Future

Our large farms are producing nearer to total capacity than our family farms. Production per acre equivalent is nearly double that of small and medium commercial family farms. Investment and production per man equivalent of available labor resources on small and medium commercial family farms are only one-fourth that on large-scale farms. Surplus capital, the ability to borrow when necessary, and informed management, have made possible the general introduction of many production innovations on large farms.[6] Profitable investments have been made in improved strains of breeding stock to upgrade their herds and flocks and in the use of preventives of diseases and pests. Increased applications of fertilizer and use of improved varieties of seed have been common among larger farms. A large proportion of available cropland has been shifted to high-producing grains and high-yielding legumes. Much of the labor is hired and it is used nearer to maximum efficiency.

To sum up, production practices on large farms are kept up to date. Limitations of capital and lack of information on available alternative production techniques are at a minimum. Increases in production may be geared to innovations now on the horizon. These farms are more nearly in balance, hence have fewer opportunities to increase output profitably.

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[6] In this connection see WILCOX, WALTER W. EFFECTS ON FARM PRICE CHANGES ON EFFICIENCY IN FARMING. Jour. Farm Econ. 33:58. February 1950.

The great technological advances of the last two decades have opened up stimulating and amazing possibilities for increased production on family farms. Increased output since the beginning of World War II is indication that many have taken advantage of new methods. Despite intensive educational and other programs, others have not, either because they did not know about them or because they did not believe they could afford it.

Increases in production by small and medium family commercial farms during the war, though striking, leave much room for improvement. Present levels of production are lower than on larger farms. To some extent, to increase this production is a function of management and capital rather than size. It is doubtful that notable efficiencies in size continue beyond a point at which the farm can adequately employ the advantages of mechanization. Needed reorganization frequently involves a change to a larger size of unit, but substantial gains can usually be made on existing acreage. For example, a study of small and medium cotton and livestock farms in the Short Leaf Pine Area of Mississippi disclosed that the opportunities for increasing crop yields are good. The yield of cotton could be increased by 46 percent, corn by almost 100 percent, egg production per hen could be doubled, and milk production per cow could be raised 90 percent.[7]

Studies made on small and medium commercial-family farms in the Southern Piedmont of North Carolina disclosed that use of improved varieties of seed, treatments for disease and insects, increased use of commercial fertilizers, better tillage, and crop rotations, could increase yields of corn by 100 percent, yields of small grains by 50 to 75 percent, and yields of hay and seed crops by 15 to 50 percent.[8] Production of milk and eggs could be increased by 50 to 80 percent over present rates through the adoption of more efficient practices. Furthermore, the increased yields of grain and hay enable a farmer to increase his numbers of productive livestock.

Increased production on large-scale farms may require the use of additional labor that is obtainable only in the labor market. Hired labor constitutes approximately 80 percent of their available labor resources.[9] Recruitment of scarce manpower in increasing production is less of a critical problem on family farms. Hired labor comprises less than one-third of the available labor resources. Family farms have an element of flexibility in the number of hours worked. Man-power in an emergency can be stretched considerably by increased participation of the old and the young and of women in certain farm operations.

If technical assistance can be made more effective and if provision can be made for adequate financing, family farms are in a position to increase substantially their contribution to the defense effort. Such assistance will also be influential in achieving the kinds of production needed in the defense period.

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[7] ELBRIDGE, A. TUCKER, WELCH, FRANK J., and DOWNING, JAMES C. FARM ORGANIZATION AND ADJUSTMENT PROBLEMS IN THE SHORT LEAF PINE AREA OF MISSISSIPPI. Miss. Agr. Expt. Sta. Bul. 405. June 1944.

[8] MCPHERSON, W. W., PIERCE, W. H., and GREENE, R. E. L. OPPORTUNITIES FOR ADJUSTMENTS IN FARMING SYSTEMS. N. C. Agr. Expt. Sta., Tech. Bul. 87. Sept. 1949.

[9] See footnote 4, p. 99.

Book Reviews

Uncle Sam's Acres. By Marion Clawson. Dodd, Mead and Company, New York, 414 pages. 1951.

HERE is a nontechnical presentation of the origin, extent, location, use, and administration of our Federally owned lands; also some discussion of the major Federal developments in regard to water. The author is a westerner who grew up in a public-land environment and is now Director of the Bureau of Land Management, Department of the Interior.

Although the picture is painted with a broad brush, considerable detail is sketched into some of the chapters, especially those relating to disposal and reservation of public lands. To some extent this may limit the appeal to the general reader, while those who have a specialized interest in public-land problems will wish that the author had made specific references to source material at certain points in the text. Inserting numbers to identify citations in the back of the book probably would not have frightened the casual reader.

Laymen readers will be rewarded with an overall view of how and why one-fourth of the land area of this country is in Federal ownership, and will become acquainted with some of the problems of public-land administration. Many people east of the Mississippi River who have not traveled in the Western States have little conception of the kinds of land owned by the Federal Government. Perhaps their only contact with Federal land is a post-office site or a military reservation. Even the national forests and the national parks in the Eastern States do not compare with the vast areas in these categories of public land in the West. Consequently, it is difficult for the laymen to understand why most of this land is not in private ownership.

Comprehension of the Federal land problem requires a knowledge of the kinds of land involved and the conditions under which the different classes of land were reserved for special types of public administration. For example, the national parks were reserved because of their unique scenic and recreational values; the national forests to protect watersheds and timber. Most of the land in the Western States now administered by the Bureau of Land Management was long open to homestead entry, but no one found it worth while to enter a claim on it under the several homestead laws. Even the forest reservations were made after much of the better, at least the more accessible, forest land had gone into private ownership. The so-called submarginal lands which were purchased in the Western States during the 1930's had been homesteaded, but settlers had failed to establish successful farms.

The author points out that private uses of Federal lands predominate under such arrangements as rentals, timber sales, and range permits. And even the 31 million visits to national parks in 1949, and the 81 million to national forests, constitute private use of these lands, although the use is for personal enjoyment rather than for production. But much of our federally owned land has a multiplicity of uses that frequently compete, and must be reconciled in the general public interest. For example, grazing on certain watersheds must be regulated to prevent floods, and to provide water supplies for farms and cities in other parts of the watershed.

Private use of much of our public land involves its utilization in combination with privately owned lands and frequently with other public lands. The western rancher may have a privately owned home ranch for the wintering of his livestock, but perhaps he is dependent upon Bureau of Land Management range for part of the grazing season and on the national forest for the rest. This system of operation grew up when there were no public restrictions on the use of Federal lands. Consequently, access to grazing on public lands to a considerable extent has become capitalized into the value of ranch headquarters. In contrast, the homesteading of humid areas that were suitable for farming involved entry on all the land. Therefore, the gradual capitalization of the use value of the homestead did not include access to free land.

In the last chapter, "Policies and Politics," the author develops a philosophy of public-land administration. In approaching this subject he recognizes that: "One's experiences, if not his biases, condition not only his analysis but what facts he seeks for analysis." Many of his suggestions do reflect his experiences in the Bureau of Land Management. The author mentions the need for widespread public discussion of Federal land problems in order to obtain a more general understanding of the public interest in these lands. He says that "no legitimate special user interest should fear from having all the facts about its interest known to the public." But the question still remains of how to obtain as adequate consideration of the public interest as of the special user interest in both the advisory process and the administrative decisions.

The conflicts in administration of public lands and in development of water resources are touched upon. In connection with water resources, the author suggests that development of a consistent water policy may be the basis for solution of some of the administrative conflicts in water development. He expresses the hope that the President's Water Policy Commission will develop an adequate policy framework. By implication at least the need for such a policy commission is indicated with respect to administration of Federal lands.

The author summarizes by pointing out that Federal land management is here to stay. There will be an increasing demand for use of public lands and greater need to conserve and develop them. Multiple uses will become more important in the future, and higher uses often will displace the lower uses of Federal lands. All of these forces will emphasize the need for capable public-land administration, which can be achieved only by a wider and more comprehensive understanding of this important public problem.

Sherman E. Johnson

The 1950's Come First. By Edwin G. Nourse. Henry Holt and Company, New York. 184 pages. c1951.

IN VIEW of the press and radio publicity that attended Dr. Nourse's resignation as the first chairman of the Council of Economic Advisers, persons acquainted with him only through these media might well expect this small volume to contain some fireworks. It does not. It is a lucid and sober analysis of a number of developments which, in his judgment, constitute serious threats to the economic progress and well-being of this country.

Dr. Nourse is concerned first of all with what may be termed "groupism"—the tendency of organized agriculture, labor, and industry to make demands which, if granted, are certain to be detrimental to the economy as a whole. Second, he is concerned with the tendency, not only of these particular groups, but of people generally, to demand from the economy, in the name of security, more than they are willing to contribute. Third, he is concerned that excessive demands in the guise of military preparedness will result in an over-commitment of the Nation's industrial system and in the imposition of oppressive controls. Finally, he is concerned that, instead of rejecting excessive demands, an attempt will be made to meet them through a continuous process of general inflation that will seriously undermine the basic strength of the economy.

This discussion of these threats to the economy is neither reactionary nor doctrinaire. He recognizes the legitimacy of many group aspirations and that groups will organize and act collectively to achieve them. He recognizes also that the desire for security is a deep-seated human craving which cannot be ignored. He does not expect that the economic system can be shaped to the ideal of free competition.

This reviewer thinks that what Dr. Nourse regards as "weak-spots in our economic armor" would be so regarded by a majority of economists. The real difference of opinion will arise with respect to the degree of apprehensiveness about them. It is rather clear that the author regards our economic system as already seriously undermined and that unless the weak spots are speedily repaired we face national insolvency and a dismal economic future. Personally, this reviewer thinks that the American economy is in considerably better shape than the author believes it to be.

James P. Cavin

Economics with Applications to Agriculture. By Edwin F. Dummeier, Richard B. Heflebower, and Theodore Norman. McGraw-Hill Book Company, New York. 718 pages. 1950.

TEXTBOOKS GROW. At least some of the better ones have, as illustrated by the fact that Alfred Marshall's famous *Principles of Economics,* first published in 1890, reached into an eighth edition in 1920.

In the current case we are concerned with the new third edition of *Economics with Applications to Agriculture,* a book first published over the names of Edwin F. Dummeier and Richard B. Heflebower in 1934, followed by a second edition in 1940. But neither the simple fact that this is now in its third edition nor the correlative fact that it is currently used as a text in some 44 colleges and universities hardly answers the question as to why it should be accorded a review in *Agricultural Economics Research.*

The fact is that this text when first published in 1934 was in several ways an interesting experiment. Not only did the authors endeavor to include within one cover an introductory course to economic principles but they more specifically tried to include also an examination of the way in which these principles might be applied or used in the agricultural field.

There is a most interesting thesis which one could develop, running to the general effect that a handful of statisticians, a few agricultural economists, and a few general economists, especially Keynes, have gone far toward bringing about a revolution in both economic theory and its application to current problems within the United States over the last 25 years or so. This thesis would rest not so much upon various theories which have been advanced but rather upon the concern of the statisticians, the agricultural economists, and equally Keynes, with the interweaving of economics and the problems of real life, with the endeavor not only to measure what was happening but also to relate the various facts to each other and fit them into some meaningful and useful framework.

It is fair to say, I think, that at the time the first edition of this book appeared in 1934 most textbook writers were not concerned with agricultural programs and farm relief. Nor did Dummeier and Heflebower necessarily endorse the programs going forward in the agricultural field; they did seem to feel that their students should not only know economic principles but should also know something about agriculture, the problems with which it was faced, and the agencies and influences at work in the field.

The fact that the book has found sufficient acceptance to warrant a third edition indicates that there was quite a bit to be said for their idea. The experiment worked.

As originally written, the book was evidently designed chiefly for students in Colleges of Agriculture who were not taking a general course in economics before studying agricultural economics. The second edition does not seem to have introduced much of a change. But in the third edition it appears that Norman and Heflebower have endeavored to do two things; (1) To strengthen their theoretical exposition, working toward a clearer and better integrated statement, and (2) to introduce more of the aggregative analyses, starting with an introduction to the national income approach in the first chapter.

Some of the shifts in emphasis are perhaps reflected in the index. For example, the references to Alfred Marshall drop from 8 in the first edition to 4 in the third, but the Marshall Plan shows up 6 times; references to Keynes increase from 4 to 7. As for the Bureau of Agricultural Economics, the number increases from 3 to 17. But these counts are incidental. The interesting thing about the index is that there are 150 or more references to the ideas, legislative acts, organizations, and individual names, which specifically belong in the agricultural economics field.

O. V. Wells

The Life of John Maynard Keynes. By R. F. Harrod. Harcourt, Brace and Company, New York. 674 pages. c. 1951.

GRANTED THAT KEYNES was the most influential economist of his generation, the question that other economists and wide-awake laymen have pondered is, Why? What was the touchstone of this great success? If this biography answers that question it is the book they want.

The explanation begins with the Norman Conquest when Keynes' ancestors took root in England. It had been a family of substance for centuries when Keynes was born in 1883. His father, a distinguished don at Cambridge University, devoted himself to logic, political economy, and administration; his mother, a graduate of Cambridge's first college for women, was a pioneer in social work, some of which was taken over by public agencies. Both outlived him. He had every encouragement to endeavor as measured by the highest standards, and he apparently inherited his lifelong interest in improvement and reform.

So potent does Harrod consider the influence of Keynes' background and student years at Cambridge that he devotes to them a third of this personal biography, as he calls this magnificent volume.

Economists know the outline of Keynes' work in economic thought and public affairs. They know his books and many of his multitudinous articles and speeches. Space here allows only reminders. But Harrod, who worked with Keynes, goes into all of this at length, with manifest understanding. Of each book he gives the setting, motivation, aims, method of work, outlines the influence or effect. Each of the great public events and movements with which Keynes was associated is covered.

Influences of Keynes' years at Cambridge differ greatly in intensity and variety from those in our universities. Although he rowed and played tennis, golf, and bridge, collected books and displayed keen interest in all the arts, he was early known as a brilliant student in discussion, debate, and studies—dominated by mathematics, political economy, logic, philosophy, psychology. At first he was under the influence of Alfred Marshall—not always. He was soon drawn into the highly selective and mentally stimulating small groups that these ancient universities foster, in which seminar and less formal methods reach their peak of excellence.

He was so advanced in thought and outlook that the line is faint between his student and faculty years. His intellectual habits intensified. His famous Monday Evenings, developed from the Political Study Club, continued until the first World War. He worked with the Young Turks. He founded a liberal weekly. Throughout life he maintained close association with Cambridge, often at no salary. Always he looked for the brilliant minds among each generation of undergraduates, not limiting his selections to economists. They were brought together in small groups and given every mental stimulation he could contrive. They sharpened their keen wits, potency of ideas, power of expression, on each other. Some of the lustrous intellects in England developed from these groups. Keynes kept in touch with them. Undoubtedly it was through these individuals that he radiated much of his influence.

The manifold benefits that Keynes extended to the arts widened his influence tremendously. His early leanings were greatly stimulated by his association for a dozen years with the brilliant Bloomsbury Group which had wide influence in England and beyond. Stephen Leslie, the philosopher, Lytton Strachey, the individualistic and iconoclastic biographer, Virginia and Leonard Woolf who opened new vistas in literature, Duncan Grant, the forward-looking painter, and many more, formed a nucleus in London, fermenting with ideas, rebelling against the stuffy and regimented, seeking new ways and new outlooks. He never lost touch with them. Later such diverse spirits as the Masefields, the Sitwells, Lowe Dickinson, Bertrand Russell, G. E. Moore, Richard Kahn, and Joan Robinson were among his intimates.

From undergraduate years Keynes frequently traveled on the Continent, often with celebrated persons who had invaluable connections. Later, others felt gratified to accompany him. He drew everywhere minds that were forceful and penetrating, he loved excitement and adventure, in reality and in the realm of ideas.

His sponsorship of the arts made him eminent in fields wherein economists rarely venture. He helped to establish the Art Theater in Cambridge which presented only the best; he was active in the London Artists Association, the Arts Council of Great Britain, the National Gallery; when London was half in ruins, he founded the Committee for the Encouragement of Arts throughout Great

Britain. He devoted himself primarily to the finances, in which these instrumentalities are notoriously weak. In England's dark hours he broadcast his ideas on Relation between Art and the State. To help France make its war repayments he coaxed an appropriation from the Treasury to buy Degas' paintings for the National Gallery.

Keynes' surprising marriage to Lydia Lopokova, the prima ballerina of the Russian ballet, is to be counted among the salient influences in his life, and, in turn, a cause of his influence. Harrod divides Keynes life into the phase of criticism, 20 years; the creative phase, 10 years. The strict discipline, work, training, and control, to which the Russian ballerinas are subjected, told her what he needed for creative endeavor; her spontaneity, poise, perception, and finely attuned mind enabled her to create the right atmosphere without too much separation from friends and activities. She was with him on all his arduous later journeys, knowing that, through a heart ailment, his stressful ardent life hung by a thread. Marrying Lydia was the best thing he ever did, said Mrs. Alfred Marshall—and she should know.

Is it necessary to outline here the great phases of public life, national and international, with which Keynes was associated? A listing could fill a page. Harrod goes into each in detail. The long controversy over the gold standard in England and the Bank of England, his management of England's external finances, the grinding work at Versailles and Paris after the first World War, the lost battle for economically repayable reparations from Germany, drawing up a new currency for Russia, the Keynes Plan which perhaps foreshadowed the Marshall Plan, the Council of Four, the Treaty of Peace. These are only a few.

Keynes spoke and published throughout, reaching for ever wider audiences. He began writing for the most influential newspapers and foreign journals, with an epigrammatic brilliance and cogency. He was awarded a peerage in 1942.

By World War II he believed that his vocation lay in public affairs and high international politics. His work relating to the International Monetary Fund, International Trade Organization, World Economic Conference, International Bank, Bretton Woods, and the American loan negotiations, necessitating eight stays in this country, is well-known. Many of our public figures are on these pages. Keynes was frequently ill but he worked with seeming undimmed vigor. If his always relentless methods of debate (with a soft voice) at times grew embittered, in general he summoned his tact and persuasive powers to help to save Britain in the crisis.

As Harrod apparently has somewhat the same remarkable complex of talents as Keynes, this biography probably ranks with the best. His declared aim is to give a balanced story and appraisal but many pages glow with a fascination of their own. His characterizations of Keynes and these celebrities whose lives were intertwined are striking vignettes yet other chapters disclose a panorama of the social, intellectual, and political life of the times. His summing up is masterly although he says the time is not ripe for a final appraisal. As Keynes was a rationalist Harrod attempts a rational explanation of his influence. He examines, in a way that many readers will find convincing, the charges of inconsistency in the light of Keynes' advancing and pioneering spirit, and the charges of too great ability to make spectacular personal financial gain. He traces Keynes' sometimes fluctuating influence and popularity. He does not offer his valuations alone, although he classes Keynes with Adam Smith and Ricardo. Characterizations are quoted from Alfred Marshall and other friends and critics through the years.

His own belief, well substantiated, seems to be that Keynes' influence came from an amazing amalgamation of heredity, intellectual environments, a keen and exploring mind of a scintillating quality, remarkable diversity of interests and contacts, amazing versatility, a liking for concentrated and sustained work, courage and daring, and endless resource and ideas.

So the memorial services in 1946 at Westminster Abbey and at the Cathedral in Washington did not mark the end, for ideas do not die with a man.

Caroline Sherman

American Resources; Their Management and Conservation. By J. RUSSELL WHITAKER and EDWARD A. ACKERMAN. Harcourt, Brace and Company, New York. 497 pages. c. 1951.

THIS BOOK DOES MORE than its title suggests. It seeks to provide current answers to two serious questions ever facing the country: What natural resources are at hand? How may we safeguard and develop them? This aspect of the book makes it a useful guide for citizens who wish an objective appraisal of these resources and an understanding of the measures needed to conserve them so that they may be used efficiently.

The authors do not present this as a "scare" book. They do not believe that deterioration of resources has brought the world or our country to the brink of a cataclysm. They seek to present a balanced, understandable analysis of the position of the United States at the midcentury, an analysis which recognizes problems but also grants hope for the future. In doing this, the authors have designed the book for use in classrooms, and by every citizen as well. It is so documented that the student, as well as the citizen who wishes to know the proof of the statements made and conclusions reached, may examine them for himself.

In dealing with the outlook for potential production the authors come to rather more hopeful conclusions than those in some other recent books on the subject but they point, on the other hand, to excessive faith in the ability of scientists to meet every need, no matter what shortages may occur from destruction of resources. It is recognized that scientists have worked wonders in solving natural limitations and opening new opportunities. But such success can make us too optimistic, for there is no substitute for natural resources as a whole, and there are limits to which one resource can be substituted for another.

In analysis of the effects of past exploitation of resources and in trying to find solutions, the authors show the difficulty of fixing clearly in the mind of every citizen the now limited opportunity for migration. Migration as a mass movement of large populations to cure economic and social ills is no longer possible, either to new lands or to faraway industrial centers, but its appeal as part of our folklore remains to be modified in the light of facts.

The subjects covered from the first chapter, Earth Bound Civilization, to the last, An American's Guide to Conservational Resource Management, go farther than most books in taking account of the social and economic and political setting of natural resource and conservation problems. Five major groups of resources are considered: (1) Cultivable lands; (2) grasslands and forest lands; (3) water resources, surface, and subsurface; (4) mineral resources; (5) fish and wildlife; and other recreational resources. This survey utilizes the findings of recognized specialists in these fields, but independently analyzes the interrelations of the different problems. A significant feature is the over-all concern with the total resource base at the level necessary to meet current and anticipated needs.

Prominence is given throughout to a recognition of the place for conservational resource management and to accompanying movements in the United States as elsewhere, that give promise for its achievement. These are resources inventories and analyses of resource traits and remedial programs on local, regional, and national levels. But they are stated to be tasks of such magnitude and complexity that completion and assessment of the results are likely to require decades.

The discussions of cultivable lands, grasslands, and forests, and water resources, are competent and important studies. They have great factual and policy significance today in the evaluation of feasible production potentials, as, How much land do we need in cultivation and in pasture, and how best to maintain its productivity economically? The authors believe that a main agricultural problem in this country in the next few years will be wise use and improvement of land that can be safely cultivated in the present arable area, rather than reclamations of undeveloped lands.

H. H. Wooten

Rural Cuba. By LOWRY NELSON. The University of Minnesota Press, Minneapolis. 185 pages. c1950.

DR. NELSON planned to make a sociological study of the Caribbean area, but upon surveying the field he believed it better to concentrate his year of study and limit it to Cuba. Sponsored by the State Department, he made the study in 1945-46.

The limiting of the work to Cuba allowed Dr. Nelson to review the Island's history in regard to land ownership and use, to analyze the available data on population, and to do fairly extensive first-hand field work. In fact, he traveled 1,800 miles by motortruck, railway, and horseback or horse-drawn vehicle in his visits to and over the areas he selected for study.

Eleven areas were selected for their representativeness of the Island as a whole. Two areas each were characterized by tobacco farming, coffee-production, sugar-cane growing; three areas were devoted largely to dairying in its different phases; and two were characterized by diversified farming under varying circumstances. At least two huge plantations, one owned by a wealthy Cuban family firm and one by an American firm, were included as well as a great many small or family-sized farms, both owned and tenant-occupied. Both white and colored people were among the operators of the farms.

The Cuban Ministry of Agriculture and the American Embassy gave full cooperation. Detailed schedules for 742 families were obtained through interviews by Cuban agriculturist inspectors, or by young Cuban women employees of the Ministry who had been trained in the School of Social Service, University of Havana. The lengthy schedule covered such matters as family composition, housing, farming, land tenure, diet, family expenditure, and recreation.

As an end product, this report gives a comprehensive view of rural Cuba through over-all descriptions of the people, the uses of the land, major crops grown, class structure, levels of living, and organization and education of rural Cuban families. The historical and census materials have been effectively integrated into the report along with human interest observations and the data compiled from the field schedule. Readers will wish, however, for photographs of the many picturesque rural situations here described so vividly.

Arthur F. Raper

Selected Recent Research Publications in Agricultural Economics Issued by the Bureau of Agricultural Economics and Cooperatively by the State Colleges[1]

BAILEY, WARREN R., and HEDGES, TRIMBLE R. ECONOMICS OF MECHANICAL COTTON HARVESTING IN THE SAN JOAQUIN VALLEY—1949. California Agr. Expt. Sta. and Bur. Agr. Econ. 48 pp., illus. Berkeley. January 1951. (RMA). (Processed.)

Machine picking, including picking costs, field waste, and grade loss, was found to have an economic advantage ranging from $3.33 in the north to $24.03 on the west side. For the Valley as a whole, it amounted to $18.83.

BOUCHARD, ROLAND J. A., and PERRY, A. L. THE DEVELOPMENT OF EXTERNAL DEFECTS IN MAINE POTATOES AT RETAIL STORES IN BOSTON, MASSACHUSETTS, FEBRUARY AND MARCH 1950. Me. Agr. Expt. Sta. Bul. 486, 24 pp., illus. November 1950. (RMA; BAE and PMA cooperating)

Total external grade defects in Maine potatoes increased approximately 57 percent from time potatoes arrived at retail stores until they were sold. Three-fourths of increase was due to increase in cuts and bruises. More careful handling is indicated.

FRICK, G. E., and WEEKS, S. B. WHEN TO HIRE AND WHEN TO OWN FARM EQUIPMENT ON NEW ENGLAND DAIRY FARMS. N. H. Ext. Cir. 302, 11 pp. March 1951. (RMA; BAE cooperating.)

Authors conclude that intelligent use of custom-hired farm machinery can assist in decreasing costs on dairy farms.

HARRIS, MARSHALL, and HILL, ELTON B. FAMILY FARM-TRANSFER ARRANGEMENTS. Ill. Ext. Serv. Cir. 680, 40 pp., illus. April 1951. (North Central Regional Publication No. 18) (Agr. Expt. Stas. of Ill., Ind., Ia., Kans., Ky., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak., and Wis., Farm. Found., and BAE cooperating.)

Designed to answer these questions: Does a member of your family wish to operate and eventually own the home farm? Do you wish to keep the farm in the family? If so, when should the plan for transfer be made and what kind of plan is best for all concerned?

HILL, ELTON B., and HARRIS, MARSHALL. FAMILY-FARM OPERATING AGREEMENTS. Mich. Agr. Expt. Sta. Special Bul. 368, 38 pp., illus. January 1951. (Agr. Expt. Stas. of Ill., Ind., Ia., Kans., Ky., Mich., Minn., Mo., Nebr., N. Dak., Ohio, S. Dak., Wis., the Farm Found., and BAE cooperating) (North Central Regional Publication 17)

Sets forth advantages of family-farm operating agreements; discusses types of agreements in use, general problems to be considered and some possible special problems.

HUGHES, WILLIAM F., and MOTHERAL, JOE R. IRRIGATED AGRICULTURE IN TEXAS. Tex. Agr. Expt. Sta. Misc. Pub. 59, 37 pp., illus. September 1950. (BAE cooperating.)

Information as to the trends in irrigation development, acres irrigated by different types of water, acreage, yield, and farm value of irrigated crops, and acres and number of farms served by the different types of organizations that provide water.

HURLBURT, VIRGIL L. BUYING OF FARMS IN STORY COUNTY, IOWA, 1940-58. Iowa Agr. Expt. Sta. Research Bul. 378, pp. 982-1015, illus. December 1950. (BAE cooperating)

Deals primarily with the buyer's side of the land market, with analysis of procedures followed by buyers in purchasing land.

OREGON AGRICULTURAL EXPERIMENT STATION. SIGNIFICANCE OF QUALITY LOSS IN MARKETING EARLY IDAHO-OREGON POTATOES. Oreg. Agr. Expt. Sta. Bul. 495, 31 pp., illus. January 1951. (Western Regional Research Publication) (RMA; Idaho Agr. Expt. Sta., Oreg. and Idaho State Dept. Agr., and BAE cooperating.)

Defects in quality were relatively high before the potatoes left shipping point. By time they arrived at terminal market, quality defects per 100-pound sack had almost doubled.

RUSH, JOHN D. ANALYSIS OF 17,906 FATAL FARM-WORK ACCIDENTS IN THE UNITED STATES, 1940-48. Bur. Agr. Econ. 23 pp., illus. April 1951. (Processed.)

Points up need for safety education in elementary schools, colleges, and universities, for integration of the information into normal study courses and its dissemination to farms.

SCOVILLE, O. J., and HODGES, J. A. PRACTICES AND COSTS ON WHEAT FARMS IN WESTERN KANSAS, 1947. Kans. Agr. Expt. Sta. Cir. 268, 27 pp., illus. December 1950. (BAE cooperating.)

Presents up-to-date information as to organization of wheat farms, production practices, current investments in machinery and equipment, and the more significant items of cost.

SIMS, GROVER J. MEAT AND MEAT ANIMALS IN WORLD WAR II. U. S. Dept. Agr. Monog. 9, 149 pp. February 1951.

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[1] Processed reports are indicated as such. All others are printed. State publications may be obtained from the issuing agencies of the respective States.

Shows trend in production of meat and meat animals and in consumption of meat; meat-animal goals; price-support programs; price control, subsidy programs, and distribution policies.

SLUSHER, M. W., and SCOGGINS, HAROLD. COTTON PRODUCTION PRACTICES IN ARKANSAS. Ark. Agr. Expt. Sta. Bul. 507, 91 pp., illus. April 1951. (BAE cooperating.)

Authors conclude that the cotton picker has not gained widespread use more because of economic reasons than of mechanical short-comings of machine. Its use is limited by its high price and necessity for level fields, free of obstructions.

SOUTHERN, JOHN H. FARM LAND OWNERSHIP IN THE SOUTHWEST. Ark. Agr. Expt. Sta. Bul. 502, 47 pp., illus. December 1950. (Agr. Expt. Stas. of La., Miss., Okla. and Tex., Farm Found., and U. S. Dept. Agr. cooperating) (Southwestern Regional Bul. 3)

Attempts to answer these questions: Who owns the farm lands of the Southwest? How is farm land held? How did these owners acquire their holdings? What plans do owners have for disposition of their lands?

THARP, MAX M., and ELLIS, HAROLD H. FATHER-SON FARM-OPERATING AGREEMENTS. U. S. Dept. Agr. Farmers' Bul. 2026, 37 pp., illus. March 1951.

Provides general information for fathers and sons who want to operate farms together for mutual benefit. Discusses father-son farm-operating agreements in detail.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. FARM PRODUCTION AND MANPOWER REQUIREMENTS. 4 pp. Washington, D. C. March 1951.

If efforts to meet the Nation's requirements are successful, the index of farm output this year will reach 143 percent of the 1935-39 average which would be the largest output of record. It is essential that a basic core of experienced regular workers be retained on farms.

UNITED STATES BUREAU OF AGRICUTURAL ECONOMICS. REVIEW AND OUTLOOK: NAVAL STORES. 27 pp., illus. Washington, D. C. April 1951. (Processed)

Prices of naval stores have fluctuated violently over the last 50 years.

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